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(54) **CHASE ME SYSTEM**

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(75) **Inventors:** **Fen-Chung Kung**, Bridgewater; **Jesse Eugene Russell**, Piscataway; **Anish Sankalia**, Iselin; **Spencer Wang**, Parsippany, all of NJ (US)

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(73) **Assignee:** **AT&T Corp.**, New York, NY (US)

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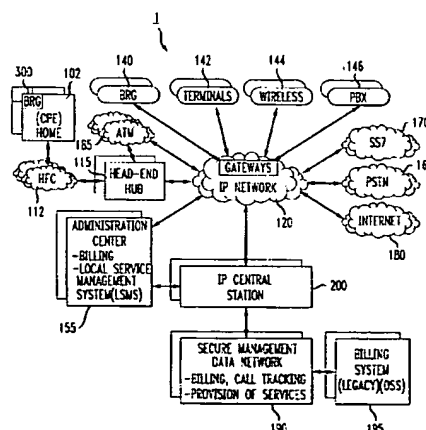
*Assistant Examiner*—Afsar M. Qureshi

(74) *Attorney, Agent, or Firm*—Banner & Witcoff, Ltd.

(57) **ABSTRACT**

A chase me method of routing a variable bit rate communication between a first terminal and a distant terminal over alternative networks including a circuit switched network and a packet network permits changing routing parameters remotely in response to user inputs including user requested changes in chasing parameters. A chase me system permits setting a chase me bit when a call is not immediately deliverable and chasing a subscriber even if the message is to be delivered by converting the message to text for delivery by paging the subscriber. A method of routing via alternative networks a calendar message, predetermined by the user for delivery at a prescribed date and time, may comprise the steps of receiving calendar input information regarding an event and a schedule; composing an event message; and chasing the user according to the reminder schedule and according to a predetermined priority of alternative network locations and terminal configurations to deliver the event message, wherein the alternative networks comprise a circuit-switched network and a packet based network.

17 Claims, 9 Drawing Sheets



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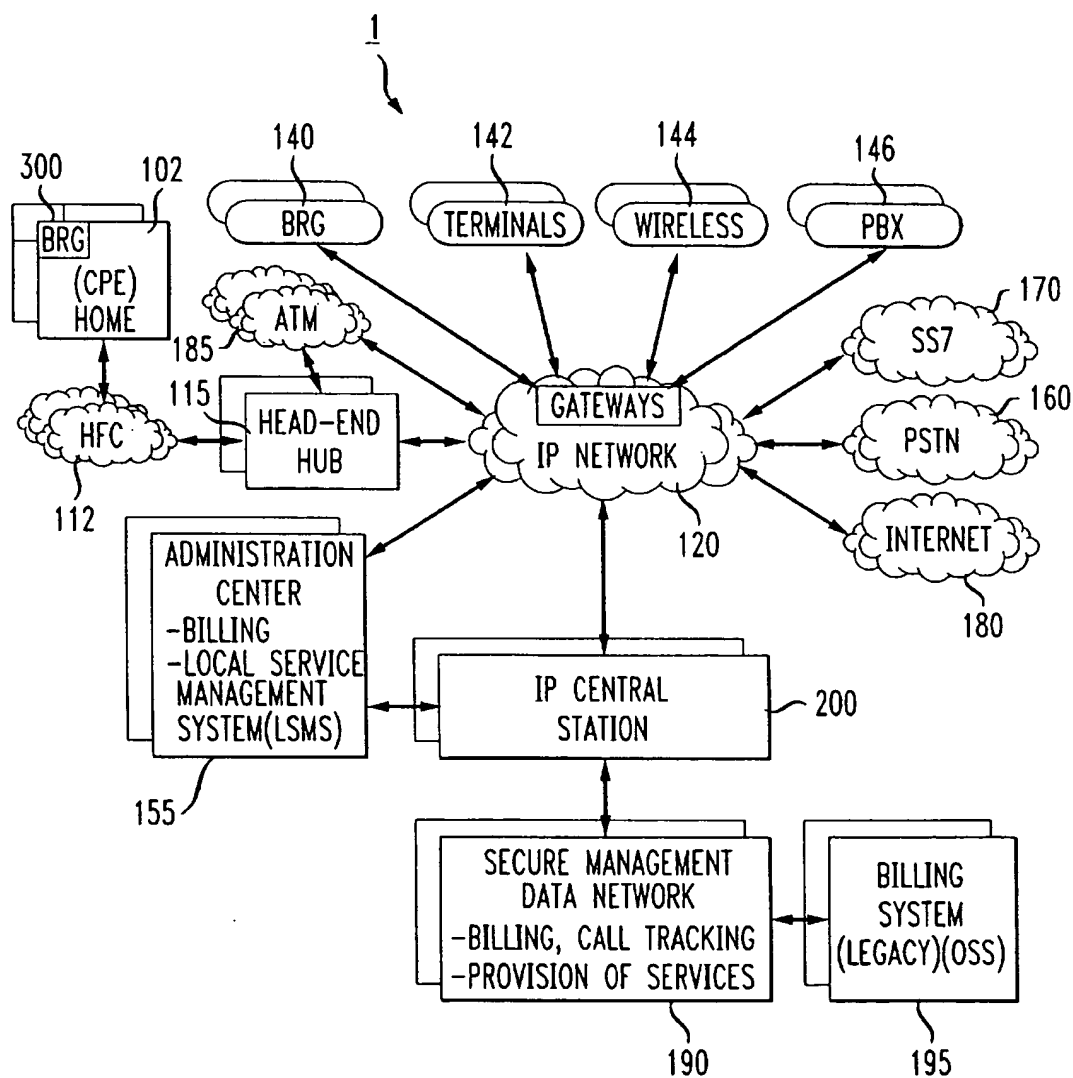
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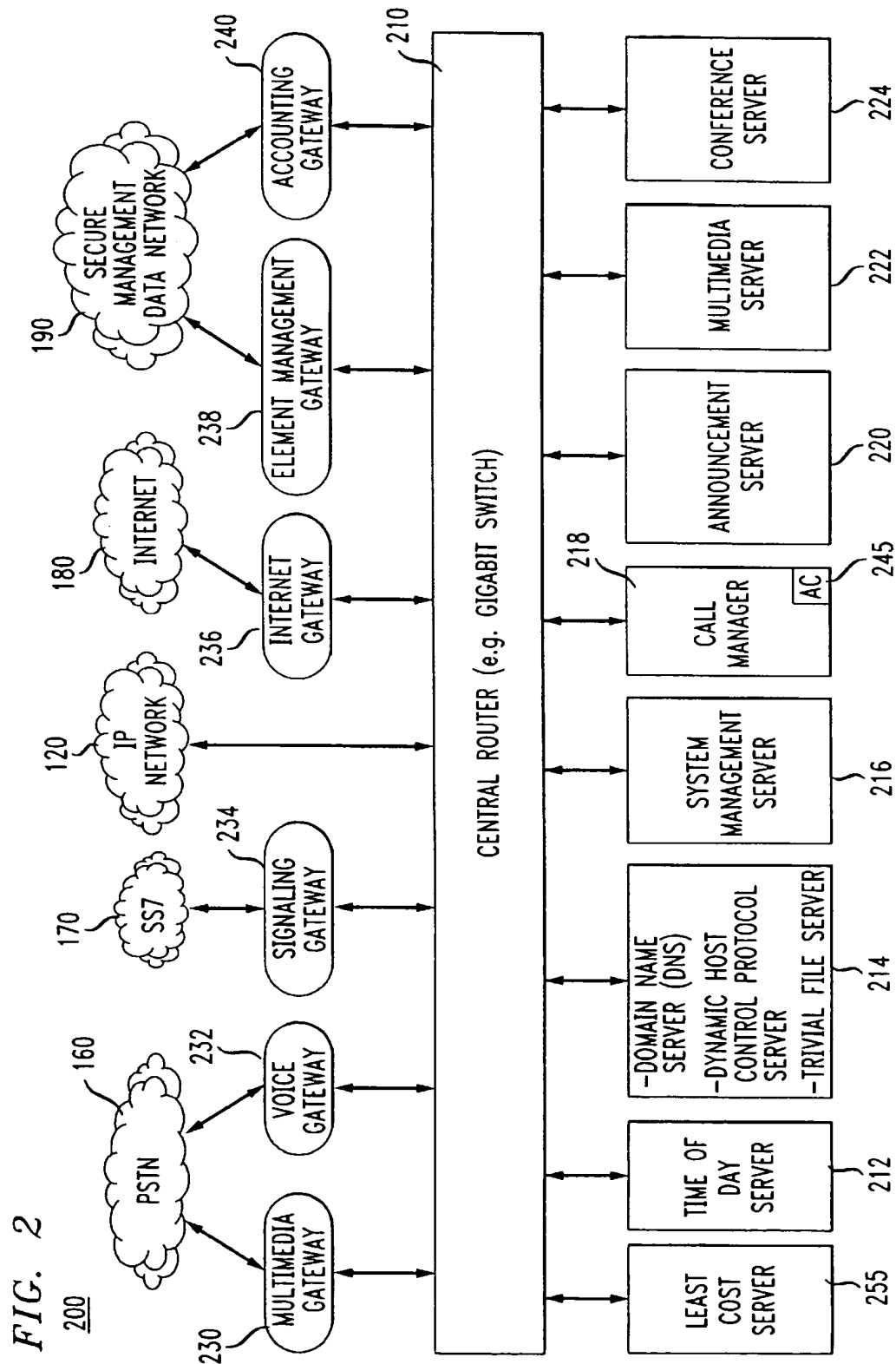
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FIG. 1





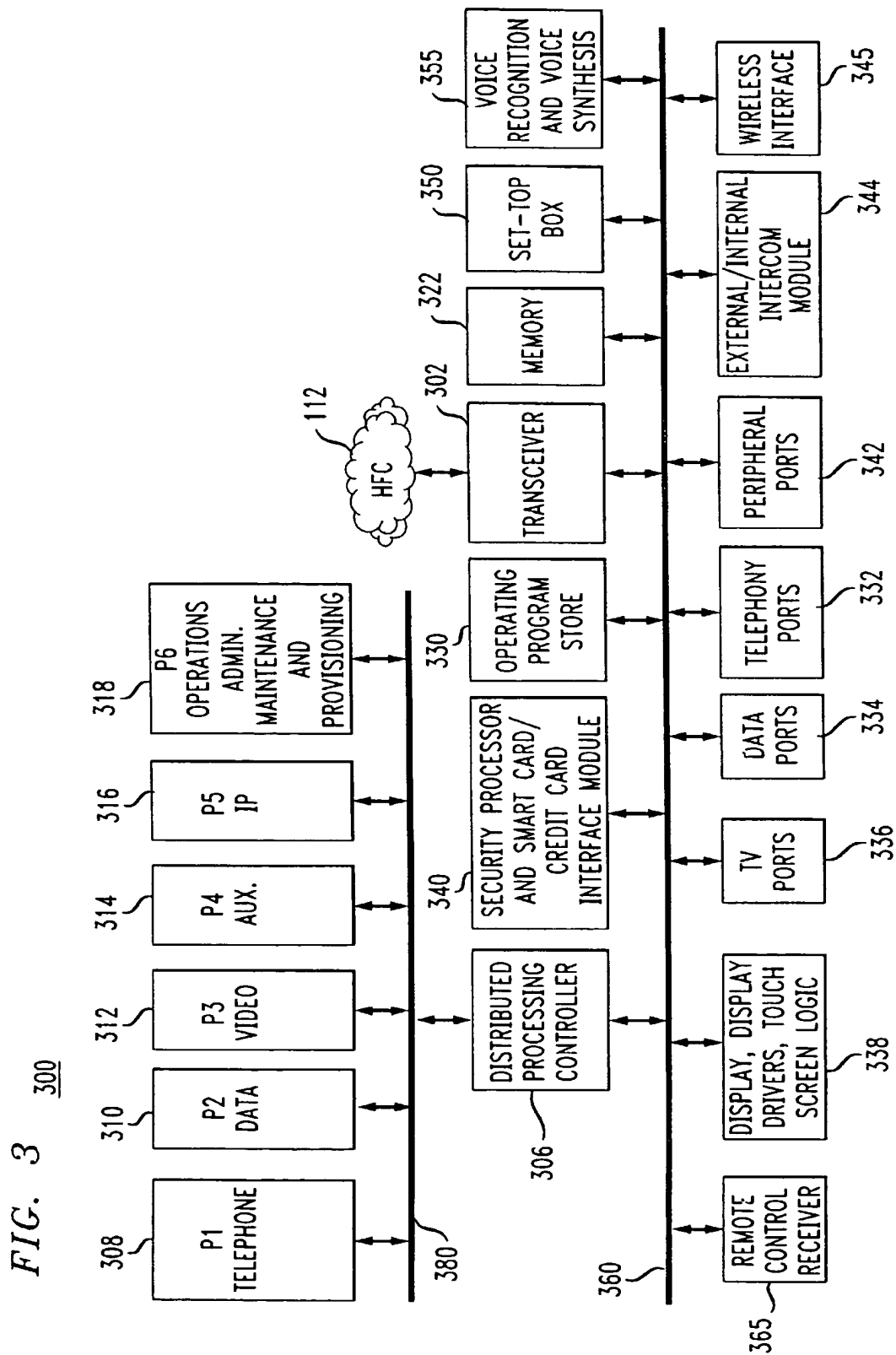
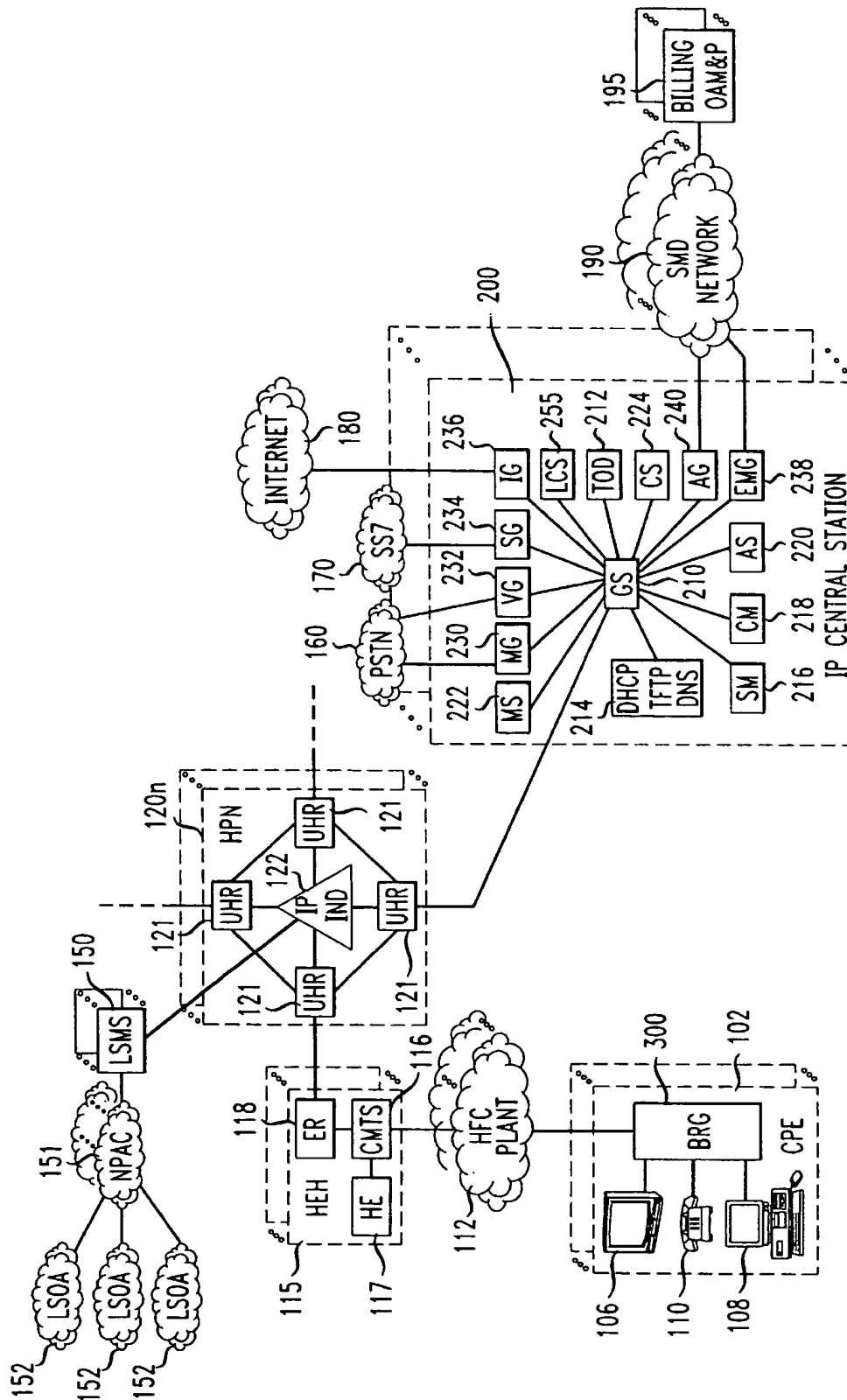
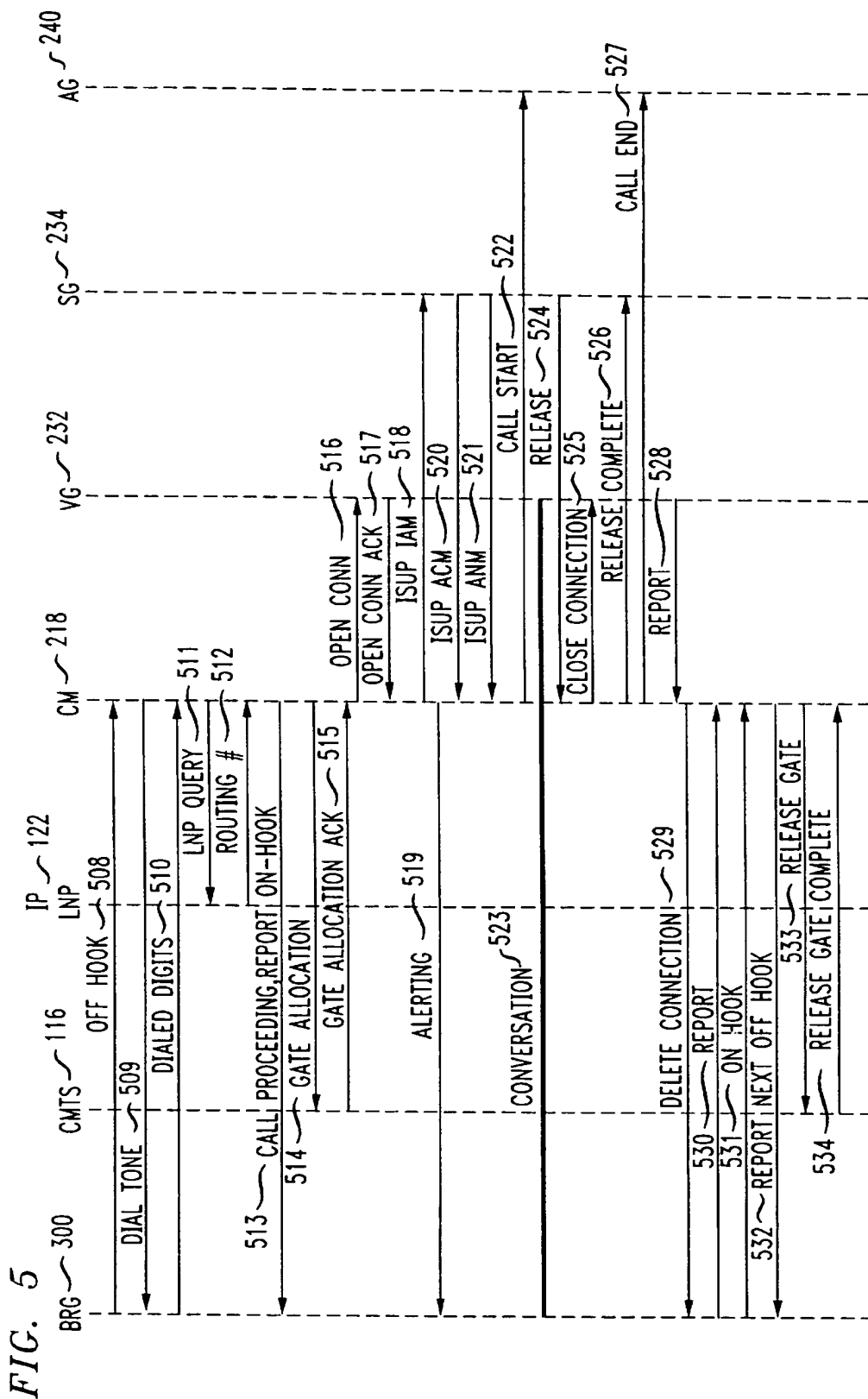
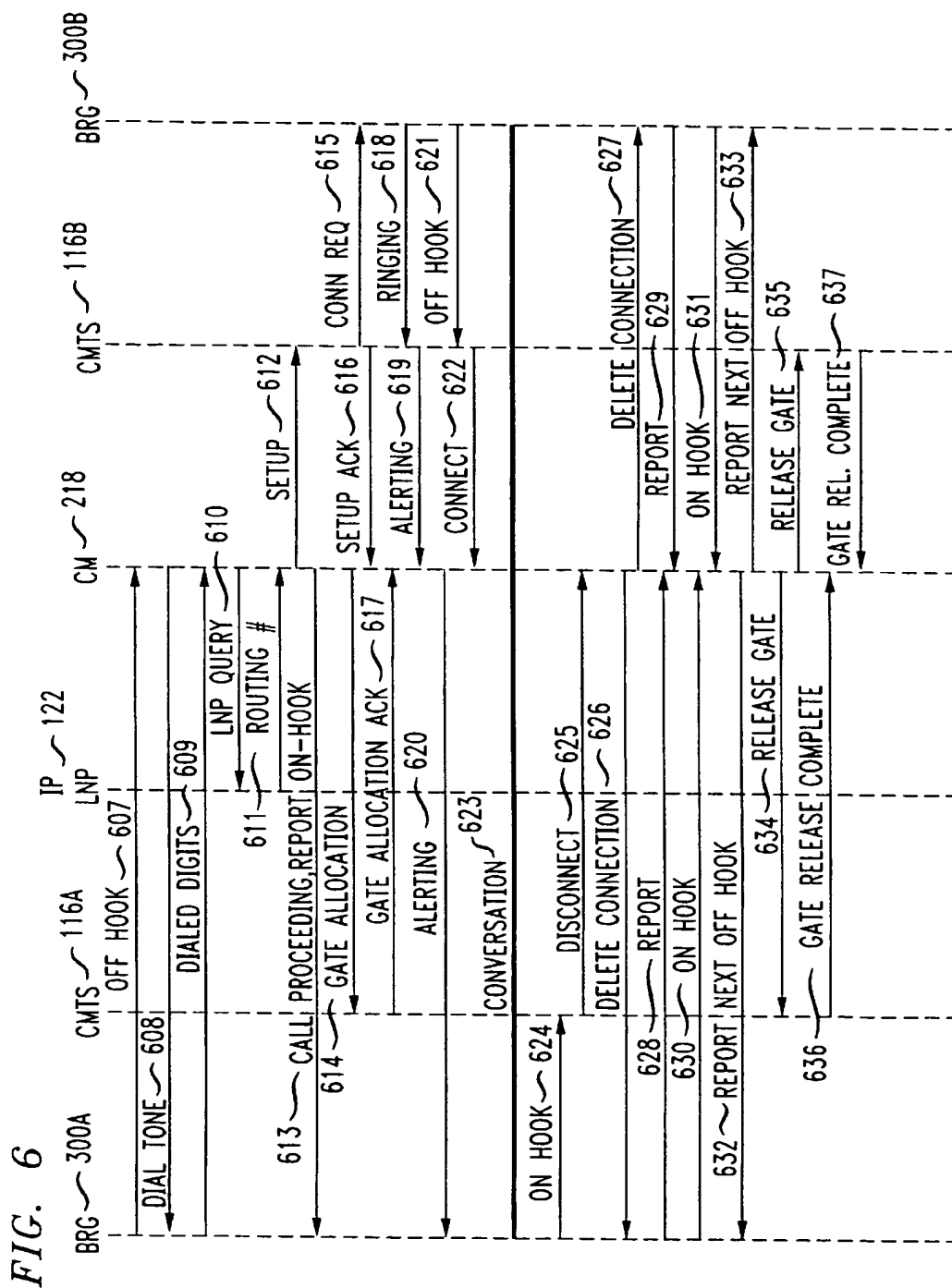


FIG. 4









*FIG. 7a*

## CHASE ME SCHEDULE

ADDRESS	TIME OF DAY	DAYS OF WEEK
301 545 1234	7:00AM - 8:00AMj 8:00PM - 10:30PM	M - FRI
smith@att.com	9:00AM - 7:00PM	M - FRI
202 508 9157	9:00AM - 7:00PM	M - FRI
smith@onet.com	7:00AM - 8:00AMj 8:00PM - 10:30PM	M - FRI
703 508 9230	8:00AM - 9:00AMj 7:00PM - 8:00PM	M - FRI

*FIG. 7b*

## CALENDAR

EVENT	TIME OF DAY	DATE	ADDRESS	MESSAGE
CHRISTMAS	12:00 NOON	12/25	mom@att.com	

⋮

MOM'S BIRTHDAY	12:00 NOON	5/15	mom@att.com	
BUSINESS MEETING	9:00 - 10:00	3/25		

*FIG. 8*

## CALLING PARTY PREFERENCE

CALLING PARTY	PREFERENCE LEVEL	CALLING ADDRESS #1	CALLING ADDRESS #2
MOM	1	301 423 5657	mom@www.com
DAD	1	301 423 5657	dad@www.com
FRIEND	2	301 467 2836	friend@www.com
BOSS	1	301 473 6850	boss@www.com

*FIG. 9*

## TERMINAL CONFIGURATION

#1	TOSHIBA LAPTOP SOFTWARE CABLE MODEM CHARACTERISTICS
#2	CA TERMINAL SOFTWARE MODEM CHARACTERISTICS
#3	TELEPHONE STATION
#4	VISION PHONE STATION

*FIG. 10*

PREFERENCE LEVEL	INSTRUCTIONS	TIME OF DAY	DAY OF WEEK
#1	CHASE ME, FOLLOW ME, BARGE IN		
#2	CHASE ME, FOLLOW ME		
#3	WILL ACCEPT IF I AM AVAILABLE		
#4	TAKE MESSAGE		
#5	FILTER		

*FIG. 11*

CALLED PARTY DATA

LOCATION	TERMINAL RESOURCES	NETWORK RESOURCES
CITY STATE COUNTRY	DATA VOICE DIGITAL VIDEO AUDIO	IP NETWORK LOCAL
	HDTV	

## CHASE ME SYSTEM

A cross-reference of related applications are provided at the end of the Detailed Description of Preferred Embodiments section of the present application.

## FIELD OF THE INVENTION

The present invention relates to methods for routing Internet broadband communications between or among users no matter where the called party may be, and more particularly, to providing multi-network access and routing among a broadband Internet Protocol Telephony Network (IPTN) and a public switched telephone network to chase called parties even when the called party may be traveling via airplane.

## BACKGROUND OF THE INVENTION

Present day telephony voice networks have a network built around circuit switches, end offices, a toll network, tandem switches, and the twisted pair wire which couples the end offices and the subscribers. These voice networks are referred to as a public switched telephone network (PSTN) and their services referred to as plain old telephone service (POTS). Due to bandwidth limitations of plain old telephone service (POTS), there is an inherent inability to efficiently integrate multiple types of media such as telephony, data communication for personal computers (PC), and television (TV) broadcasts. Accordingly, a new broadband architecture is required. This new architecture gives rise to a new array of user services.

Presently, routing may be provided for POTS services by locating a forwarding telephone number for a given circuit switched call between a caller and a called party, especially in a business context. For example, private branch exchange systems permit a user to select a station other than their own for routing a call, for example, to a conference room where they are going to be. On the other hand, the Internet and other packet-based networks promise multimedia communication opportunities including but not limited to video teleconferencing, high resolution imagery transmission and high fidelity digital sound. Consequently, there is needed in the art an opportunity to provide call forwarding services in the event of multimedia calls.

For example, a multimedia call may be converted to voice and delivered to a telephone terminal or a text e-mail may be converted to voice and likewise delivered while a multimedia call may be received with full capabilities at a vision phone or a personal computer. Moreover, a voice call should be capable of delivery to a subscriber traveling on a plane via paging services by voice-to-text conversion.

Consequently, there exists a great opportunity to provide new methods and procedures for chasing IP broadband subscribers for such multi-media communications and to further provide routing options and updating of call forwarding options remotely via the Internet or telecommunications network.

## SUMMARY OF THE INVENTION

Aspects of the invention include providing broadband access capabilities or enhanced services for use in conjunction with a packetized network such as an Internet Protocol (IP) based system infrastructure.

Other aspects of the invention include providing one or more of the following either individually, or in any combination or subcombination:

a new broadband architecture;  
broadband network capabilities, including local access;  
enhanced multi-media services for use in conjunction with a packetized network such as an Internet Protocol (IP) based system infrastructure;  
utilizing a SIM card to validate a user associated with a subscriber or off-premises location;  
providing users with choices of networks including the PSTN, an IPTN, a wireless or other available networks, routing a call to a called party via any alternative network possible and in accordance with any such routing choices input by a user; and  
providing real-time selection choices to the subscriber for personal calendar reminder services no matter where the subscriber may be.

According to the present invention, a method of providing alternate routing for a variable bit rate communication between a first terminal and a distant terminal to a broadband subscriber at the first terminal, the variable bit rate communication being a multimedia communication requiring an audio speaker and a video display and related to the degree of utilization of a plurality of different networks, the different networks comprising at least a packet switched network and a circuit-switched network, comprises the steps of: i.) receiving a multimedia communication at a first terminal and ii) if the called party is not at a premises where the first terminal is located and the called party has authorized chasing service, setting a data chasing bit representing that the called party was not at a primary location and iii) alerting the calling party that the called party is not at the primary location and offering one of messaging service or chasing service to the calling party for the multimedia communication. Dependent features include alerting the called party that the call is a chasing call, comparing a terminal configuration for the called party with multimedia communication delivery requirements and converting the multimedia communication from one media to another if required.

In a further embodiment of the chase me system of the invention, a method of routing a calendar message, predetermined by the user for delivery at a prescribed date and time, comprises the steps of receiving calendar input information regarding an event and a reminder schedule, composing a reminder message and chasing the user according to the reminder schedule and according to a predetermined priority of alternative network locations and terminal configurations, and chasing the user to deliver the calendar message, wherein the alternative networks comprise a circuit-switched network and a packet based network. Dependent features include alerting the called party user that the call is a chasing call, comparing a terminal configuration for the called party with calendar communication delivery requirements and converting the calendar communication from one media to another if required.

Although the invention has been defined using the appended claims, these claims are exemplary and limiting to the extent that the invention is meant to include one or more elements from the apparatus and methods described herein and in the applications incorporated by reference in any combination or subcombination. Accordingly, there is any number of alternative combinations for defining the invention, which incorporate one or more elements from the specification (including the drawings, claims, and applications incorporated by reference) in any combinations or subcombinations.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic representation of a broadband network (for example, broadband IP based network) in

accordance with a preferred embodiment of aspects of the present invention.

FIG. 2 shows a block diagram of a preferred embodiment of a centralized control (IP central station) in accordance with aspects of the present invention.

FIG. 3 shows a block diagram of a preferred embodiment of a local control apparatus (broadband residential gateway) in accordance with aspects of the present invention.

FIG. 4 shows a detailed schematic representation of an exemplary embodiment of the broadband network shown in FIG. 1.

FIG. 5 is a signal flow diagram illustrating a typical on-network to off-network call according to one preferred method of operating the broadband network shown in FIG. 1.

FIG. 6 is a signal flow diagram illustrating a typical on-network to on-network call according to one preferred method of operating the broadband network shown in FIG. 1.

FIG. 7 is a collection of screen portions which may comprise screens displayed on displays to users of a chase me system according to the present invention such as call set up screens, call progress screens and alternative call routing screens; FIG. 7(a) is a representative screen portion whereby a user may select and/or the screen portion may display parameters for a chase me service; and FIG. 7(b) is a representative screen portion whereby a user may select and/or the screen portion may display a calendar of events.

FIG. 8 is one embodiment of a representative screen or a screen portion whereby a user may select and/or a terminal display calling party preferences including chase me/follow me instructions for an incoming Communication to a user via displays such as user profile screens, terminal configuration screens and call set up screens; for a second or other users for example there may be associated screens and/or screen portions for each other user.

FIG. 9 is a collection of screen portions which may comprise screens for terminal configuration for entry and display of terminal characteristics including hardware, software and interface characteristics.

FIG. 10 is an example of one embodiment of a call preference screen portion of a display such as a user profile screen, a terminal configuration screen and a call set up screen whereby user may specify a calling party preference level and an associated instruction set for the calling party and their call processing.

FIG. 11 is an example of one embodiment of one call set-up screen whereby a call manager may report to a broadband gateway at a user location on the characteristics of a called party or calling party terminal configuration including their location, terminal resources and network resources.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A new system is provided for broadband multimedia access and chase me system applications providing alternative routing for a multimedia communication in accordance with the user's selection of a chase me service including a chase me schedule, a calendar of events, and calling party preference parameters among other user selections. Unless otherwise indicated by the appended claims, the present invention is not limited to the preferred embodiments described in this section but is applicable to other integrated multimedia communication systems.

#### 1. Integrated Communication System Overview

Referring to FIG. 1, an exemplary embodiment of a broadband network 1. The broadband network generally provides interconnection between a plurality of customer locations utilizing various interconnection architectures including an Internet Protocol (IP) based network, various existing systems (legacy systems) such as the public switched telephone network (PSTN), ATM networks, the Internet, signaling networks, as well as other systems. The broadband network provides versatile intelligent conduits that may carry, for example, Internet Protocol (IP) telephony or multimedia signals between the customer premises over, for example, the public switched telephone network, Internet, or wireless communication networks. All networks shown in FIG. 1 may be generally categorized as either circuit-switched networks or packet-switched or packet-based networks. Circuit-switched networks generally involve the creation of an end-to-end facility that is dedicated to a given communication while packet-switched networks share common facilities; (a data packet is addressed and can follow a plurality of paths to an addressed far end terminal).

Again referring to FIG. 1, the broadband network 1 may include one or more customer premises equipment (CPE) units 102. The customer premise equipment 102 may be variously configured. In one example, the customer premise equipment 102 may include one or more local control devices such as a broadband residential gateway (BRG) 300. Although the broadband residential gateway is preferably disposed in a residence for many aspects of the invention, in exemplary embodiments, it may also be disposed in a business, government or other location. The broadband residential gateway 300 may be variously configured to provide one or more integrated communication interfaces to other devices within the customer premise equipment 102 such as televisions (TV), personal computers (PC), plain old telephone system (POTS) phone(s), video phones, IP enabled phones, and other devices. For example, the broadband residential gateway 300 may provide one or more telephone port connections (for example, plain old telephone system), Ethernet connections, coaxial connections, fiber distributed data interface (FDDI) connections, wireless local area network (LAN) connections, firewire connections, and/or other connections to a plurality of devices such as plain old telephones, IP based phones, television converters, for example, cable television (CATV) set top devices, televisions, digital televisions, high definition televisions (HDTV), video phones, and other devices. In exemplary embodiments, the broadband residential gateway 300 may support communications between any of the aforementioned devices in intra-premises calling and/or extra-premises calling. The BRG 300 takes an inventory of addresses of all connected apparatus and may report terminal capabilities (a terminal configuration) to a call manager of an IP Central Station 200 (FIG. 2), as will be further discussed herein, to enable calling party multimedia capabilities compatible with called party multimedia capabilities. Further, when the broadband residential gateway 300 is used in a business or government environment, it can function as a private branch exchange or key type telephone system.

In FIG. 1, broadband residential gateway 300 is illustrated as a single physical device. This configuration is appropriate where centralization of maintenance and control is desirable. Alternatively, the broadband residential gateway 300 may be separated into more than one physical device allowing functionality to be distributed to a plurality of different physical locations in the customer premise and/or broadband

network 1. However, in many embodiments, having a centralized broadband residential gateway 300 located in a single location provides ease of maintenance, control, and re-configuration as well as a reduction in cost due to shared functionality. For example, the broadband residential gateway may be configured to provide the intelligence needed to allow each of the customer premises equipment devices to operate within the broadband network 1. For example, analog voice may be converted to digital data and packetized for transmission in an appropriate output protocol such as an Internet protocol (IP).

In exemplary embodiments, the broadband residential gateway 300 may function to couple devices within the customer premise equipment 102 to the rest of the broadband network 1 using any suitable broadband communication mechanism. In the embodiment shown in FIG. 1, the broadband residential gateway 300 utilizes a hybrid fiber-coaxial plant 112 to couple the broadband residential gateway 300 to the rest of the broadband network 1. The hybrid fiber-coaxial plant 112 may be preferred in many embodiments over other broadband communication mechanisms because of the large number of homes currently connected to cable networks, the capacity for shared access, and the ability for asymmetric data access speeds which allow high quantities of data to be distributed to the various devices in the customer premises equipment 112. The hybrid fiber-coaxial plant 112 may include coaxial cable and/or optical fiber networks in any suitable combination. The hybrid fiber-coaxial plant 112 may provide an intelligent broadband conduit between the broadband residential gateway 300 and a gateway such as the head-end hub (HEH) 115. The head-end hub 115 may be variously configured to provide various services and/or interconnections with the rest of the broadband network 1. For example, the head-end hub 115 may provide an interconnection point to gather and aggregate external services (for example, off air and satellite video, public switched telephone network voice, multimedia messages, and Internet data) for distribution to and from the hybrid fiber-coaxial plant 112. With respect to telephony and multimedia calls, the head-end hub 115 may function as intelligent conduit for connection and communication between the hybrid fiber-coaxial plant 112 and external networks such as an IP network 120 and/or an ATM/frame relay/cell relay network 185.

The broadband network 1 may include any number of interconnected head-end hubs 115, IP networks 120, and/or ATM networks 185. Further, the IP network 120 and/or ATM network 185 may be connected to one or more other networks and devices such as:

- (1) external networks including a public switched telephone network (PSTN) 170, an signaling system seven (SS7) network 170, an Internet 180, and/or a wireless network 144;
- (2) various components including one or more private branch exchanges 146, terminals 142 including computers and wireless devices, and/or one or more stand alone broadband residential gateway 300;
- (3) one or more administration centers 155;
- (4) one or more secure network management data networks 190 such as a network operations center (NOC);
- (5) one or more billing systems 195 such as OSS; and/or
- (6) one or more centralized control centers such as what is referred to as an IP central station 200.

The IP network 120 and/or ATM network 185 (examples of packet-switched networks) may include one or more routers and/or other devices to route, for example, telephony

calls, multimedia calls, signaling messages, administrative messages, programming messages and/or computer data between the various devices in the broadband network 1 such as the head-end hub 115, the public switched telephone network 160, the private branch exchange (PBX) 146, as well as the other devices discussed above. In preferred embodiments, the information traveling in the IP network 120 may be packetized and formatted in accordance with one of the Internet protocols. The IP network 120 may also include gateways to interface with the various other networks and/or devices. For example, the gateways may be distributed at the edge of the IP network where the IP network interfaces with one of the other devices or networks. Alternatively, the gateways interfacing the IP central station 200 to, for example, the Internet 180, public switched telephone network (PSTN) 160, signaling system 7 (SS7) 170, wireless networks 144, ATM/frame/cell relay networks 185 may be provided in the IP central station 200, or in both the IP network 120 and the IP central station 200, and/or partially distributed between the IP network 120 and the IP central station 200. Where the gateways are separated by an IP network 200, an appropriate transport protocol may be utilized to logically connect the IP central station 200 to the particular gateway.

The IP central station(s) 200 may be connected to, for example, one or more IP networks 120, ATM networks 185, secure management data networks 190, and/or administration centers 155. The IP central station 200 may be variously configured to include one or more servers and/or one or more gateways. In exemplary embodiments, the servers and gateways provide the necessary intelligence and traffic management capabilities to enable information, for example, IP telephony signals, to travel through the broadband network 1. For example, the IP central station 200 may be configured to manage voice information transfer from the public switched telephone network 160, through the IP network 120, and into and out of one or more devices such as those connected to a broadband residential gateway 300. The IP central station may be configured to store various control and system information such as location, address, and/or configurations of one or more broadband residential gateways 300, as well as other routing and call set-up information.

In exemplary embodiments, one or more administration centers 155 may be connected to the IP network 120 and provide billing and local directory number portability administration. The local number portability may be handled by one or more Local Service Management System (LSMS) which may be included in the administration center 155 and/or in the IP central station 200. Further, the Secure Management Data Network 190 may also include a mechanism for translating various information such as billing, call tracking, and/or customer service provisioning. Various existing systems may be utilized to provide this information such as existing billing systems (OSS) 195 and/or one or more network operations center (NOC). The network operations centers may be included in the administration center 155, the IP central station 200, and/or the billing system 195. The network operations center (NOC) may be variously configured to include a translation server to allow communications with the various disparate entities (for example, legacy systems) in the broadband network 1.

The IP network 120 and/or the ATM network 185 illustrated in FIG. 1 may include one or a plurality of sub-networks. Each of the sub-networks may include its own IP central station 200 in a distributed configuration, with certain routing data replicated across all IP central stations or

each sub-network may be connected to a single centralized IP central station 200. Where the IP network 120 includes one or more sub-networks, each sub-network may be connected to multiple head-end hubs 115. Further, each head-end hub 115 may be connected to multiple hybrid fiber-coaxial plants 112, and each hybrid fiber-coaxial plant 112 may be connected to multiple pieces of customer premises equipment 102 and/or broadband residential gateways 300. The IP network 120 provides an interconnected broadband network which may be utilized to transport and route packetized information to and from diverse geographic locations and may be used on a national or international basis. Further, the IP network 120 and/or ATM network 185 may utilize private network facilities and/or may be provisioned over a shared network such as the Internet.

The IP central station 200 may be configured to provide connectivity for the broadband residential gateway 300 to the Internet 180 (for example, World Wide Web (www)), as well as connectivity to other external networks such as public switched telephone network 160 and signaling system seven (SS7) 170 for end-to-end voice, multimedia, and data applications, for example voice over IP telephony. IP packets traveling through the IP network provide for priority so that, for example, voice packets may be typically given priority over data packets to maintain certain VoIP telephony QoS requirements. On the other hand, a leased line concept for packet traffic may have an even higher priority than a voice communication. A user may change quality of service and their required bit rate and, hence, the priority of the communication in real time in response to user input. Thus, the system is sufficiently flexible so that the priority of a given communication can be dynamically altered according to customer preferences, variable billing rates and tariffs, the user's bit rate requirements, the user's desired quality of service, traffic patterns, and/or congestion.

#### A. Internet Protocol Central Station

Referring to FIG. 2, the IP central station 200 may be variously configured. In preferred embodiments, it may be configured to ensure seamless integration of packet based communication system including the IP network 120 (for example, AT&T or selected service provider for a subscriber) with the public switched telephone network 160, signaling system 7 (SS7) network 170, and the Internet 180 (other ISP's than AT&T or the selected service provider) so that packetized data, for example, voice calls and information data, is properly transferred between the broadband residential gateway 300, the public switched telephone network 160 (for simplicity, including wireless and paging networks), and/or the Internet 180. In one embodiment, the hybrid fiber-coaxial plant 112, head-end hub 115, and IP network 120, provide a virtual signaling conduit for packetized voice and data which may, with the coordination of the IP central station 200, be provided in the appropriate format between the broadband residential gateway 300 and the public switched telephone network 160 and/or Internet 180.

Again referring now to FIG. 2, the IP central station 200 may include a central router 210, for example, a gigabit switch, which may be utilized to interconnect various servers and gateways contained in the IP central station 200. The central router 210 provides for example Ethernet switching and aggregates traffic between servers, gateways and the IP network 120 and/or ATM network 185 backbone. In one exemplary embodiment, the central router 210 provides high-speed, non-blocking IP and IP multicast Layer 3 switching and routing. The IP central station 200 may include one or more of the following servers: the least cost

server (LCS) 255, the time of day (TOD) server 212, the dynamic host control protocol (DHCP) server, the trivial file transfer protocol (TFTP) server, and the domain name service (DNS) server 214, the system management (SM) server 216, the call manager (CM) server 218, the announcement server (AS) 220, the multimedia server (MS) 222, and/or the conference server (CS) 224. As illustrated in FIG. 2, the servers may be separate servers, for example the call manager server 218, or may be incorporated into a single server. In the exemplary embodiment, the dynamic host control protocol server 131, trivial file transfer protocol server 132, and the domain name service server 214 are each incorporated in a single server facility. Each server in the IP central station 200 may include computer(s), storage device(s), and specialized software for implementing particular predefined functions associated with each server. In this manner, the servers in the IP central station may be provisioned as a main server and one or more back-up servers to provide redundant processing capabilities. Similarly, the router may be implemented as a main router and a back-up router with similar routing functionality.

The IP central station 200 may also include, for example, one or more of the following gateways: an element management gateway (EMG) 238, an accounting gateway (AG) 240, an Internet (Boarder) gateway (IG) 236, a signaling system 7 (SS7) gateway (SG) 234, a voice gateway (VG) 232, and/or a multimedia gateway (MG) 230. The IP central station 200 may utilize one or more of these gateways to provide centralized system intelligence and control of voice and/or data IP packets.

In exemplary embodiments, the dynamic host control protocol server and domain name service server 214 may operate to dynamically assign IP addresses to devices in the customer premise equipment 102. Where a dynamic IP assignment scheme is used, the customer premises equipment may be provided with one or a plurality of dynamic IP assignment when activated initially, and/or at the initiation of each active session. Where an IP address is assigned when the device is initially activated, it may be desirable to assign a single IP address to a single broadband residential gateway and assign a port address to devices connected to the broadband residential gateway 300. In other embodiments, an individual IP address may be assigned to each device coupled to the broadband residential gateway 300. For example, the broadband residential gateway may include and/or be coupled to one or more cable modems, IP phones, plain old telephone system phones, computers, wireless devices, CATV converters, video phones, and/or other devices which each may be assigned a unique static and/or dynamic IP address and/or a port of a one of these IP addresses. Each of these different terminal devices may have different capabilities for different multi-media services: the telephone is limited to voice telephony while a fully equipped personal computer (including a video camera and microphone) has full multimedia broadband capabilities. As will be discussed further herein, the user may request a communication that cannot be accomplished by the terminal configuration and the BRG may provide an appropriate error message suggesting the user move to another terminal.

The particular protocol for allocating IP addresses and/or ports may be specified using protocols defined in the dynamic host control protocol server 214. In exemplary embodiments, the dynamic host control protocol and DN server 214 may be configured to assign available IP addresses from address pools based, for example, on the identity or type of requesting device, the amount of use

expected for the requesting device, and/or predefined assignment protocols defined in the dynamic host control protocol and DN server 214. The identifiers provided for given equipment and temporarily stored at a broadband residential gateway can be translated to provide capabilities for, for example, for high fidelity audio reception and transmission, high definition television reception or transmission and the like at a given user location within a residence, business or government location and thus reported to an IP central station 200 at call set-up. In centralized embodiments, it may be desirable to configure the call manager (CM) 218 to provide sufficient information such that the domain name service server 214 can distinguish between static IP devices, dynamic IP devices, registered devices, unregistered devices, and registered devices that have been assigned to a particular class of service for example, data vs. telephony, un-provisioned, vs. provisioned, etc.

The trivial file transfer protocol (TFTP) server 214 may be configured to transfer certain information to/from one or more broadband residential gateways 300. In exemplary embodiments, the trivial file transfer protocol server provides Data Over Cable Service Interface Specifications (DOCSIS) configuration information containing QoS parameters, terminal configuration and other information required for the broadband residential gateway 300 to operate optimally.

The time-of-day (TOD) server 212 may include a suitable facility for maintaining a real time clock such as an RFC868-compliant time server. In exemplary embodiments, the time-of-day server 212 provides system messages and/or responses to system inquiries containing a coordinated time, for example, universal coordinated time (UCT). The universal coordinated time may be used by any of the servers and/or devices in the broadband network 1. For example, the broadband residential gateway 300 may use the universal coordinated time to calculate the local time for time-stamping of communication processing, files and logs, including error logs. In accordance with the present invention, the time-of-day server provides time-of-day and date or day of week scheduling for chase me schedules and event calendars (FIG. 7).

The system management (SM) server 216 may include responsibility for the overall operational state and functioning of components the broadband network 1, either alone, or in combination with other system management servers 216. The system management (SM) server 216 may be variously configured to provide monitoring and administrative functions for devices within the broadband network 1. For example, the system management server 216 may be configured to provide management of various database functions, memory buffer functions, and software utility functions within the broadband network 1. Software management includes, for example, version control, generic control, and/or module control.

The least cost server (LCS) 255 may be variously configured to enable the system to determine alternative routes available for a communication and the least cost routing of telephone and data transmission throughout the network. The least cost server 255 may also provide one or more broadband residential gateway users the capability to select among, for example, service provider, data rate, cost and Quality of Service (QoS) as well as add or delete parties to/from a communication. The least cost server 255 coordinates with the TFTP server 214 to obtain remote terminal configuration data as necessary.

The announcement service (AS) server 220 may be variously configured. In exemplary embodiments, it may store

and send announcements to specified destinations and/or all destinations based on instructions received by, for example, the call manager (CM) server 218. The announcement server 220 receives, for example, Media Gateway Control Protocol (MGCP) or later signaling (for example, H.GCP—an ITU standard Gateway Control Protocol) control messages from the call manager 218, and sends announcements to one or more voice gateways (VG) 232 and/or the one or more broadband residential gateway 300 (for example, using Real Time Protocol (RTP) packets). The announcement server 220 may send an announcement once, a predetermined number of times, or in a continuous loop.

The announcement server 220 may detect when a phone or other device has been taken off-hook and play an advertisement or other announcement to the user. Where a user has signed-up for an advertising plan whereby phone rates are reduced in return for advertising revenue generated by the advertisements, the announcement server 220 may be utilized to track the number of individuals with a particular income, age, or other profile which hear the advertisement. The announcement server 220 may respond to requests from individual system devices such as one of the broadband residential gateways 300 and/or under control of, for example, the call manager 218. Where the announcement server is under control of the call manager 218, the call manager may be configured to control various operating parameters of the announcement server. For example, the call manager 218 may request that certain announcements are sent once, a specified number of times, or in a continuous loop.

In still further embodiments, announcements may be generated elsewhere in the broadband network 1, stored as files, and distributed to one or more announcement servers via a file transfer protocol or resource such as the trivial file server 214 using one or more file transfer protocols. In many embodiments, it is desirable to store announcements in an appropriate encoding format (for example, G.711 or G.729) within the Announcement Server. The announcement may have an audio component and/or a audio/video component. The audio/video component may be stored using a combination of an encoding format (for example, G.711) and/or a standard file format such as wave (WAV), MPEG, and other suitable formats.

In one exemplary method of operation, a user picks up a telephone which sends a signal to the call manager 218. Subsequently, the call manager 218 may establish a connection to the announcement server 220 and play one or more pre-recorded and/or predetermined announcement (hypertext and/or audio). Signaling tones such as dial tone, audible ringing tone, or a called party busy signal may be played by the broadband residential gateway 300 or the call manager 218, but Special Information Tones (SIT) and/or messages may also be included as part of an announcement file. In this way, the user experience is enhanced such that the user receives a busy message and/or hypertext announcement providing one of several options for contacting the called party. The announcement server 220 may have information entered by a user using, for example, a broadband residential gateway 140 to provide additional information to the called party. The additional information may include the ability to leave a message, type-in a chat note, page the called party, barge-in on the call, and/or other user or system defined call handling capabilities.

The announcement server 220 may also be programmed with various system messages such as an announcement indicating that a number dialed is incorrect or that the call did not go through as dialed, that the lines are busy, that all



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lines between two countries are currently busy, that the called party has changed numbers, that the called party's phone has been disconnected, that one or more system errors have occurred, and/or other announcement messages. In accordance with the present invention, when a chase me bit is set and stored in memory with the call status, indicating that a communication has been delivered at least once to an address where the called party is presently not located, the called party, once reached, may be alerted that the call is a chasing call. Moreover, the calling party may be given an announcement indicating that the caller may leave a message or the system will try to chase the called party until they can be reached (assuming chase me service has been authorized).

The call manager (CM) 218 may be variously configured. In exemplary embodiments, the call manager 218 provides a centralized call control center for supporting call set-up, call change and tear-down in the broadband network 1. The call manager 218 may be configured to include trunk and line information maintenance, call state maintenance for the duration of a call, and/or user service features execution. The call manager 218 may also provide for call processing functions such as a standardized call model for processing the various voice connections such as voice over IP calls. In exemplary embodiments, a standardized "open" call model may be utilized which Supports standardized application programming interfaces (APIs) to provide transport services and other user functions such as calling cards. An open application programming interface and call set-up interface in the call manager enables third party applications to be loaded into the call manager 218 and broadband residential gateway 300. This will facilitate the development of third party applications for enhancing the functionality of components in the broadband network 1. For example, third parties and other equipment vendors may manufacture various broadband residential gateways 300 for use in the broadband network 1 by writing applications to support the open call model of the call manager 218. The call manager 218 and/or broadband residential gateway 300 may also be configured to execute and/or accept commands from a standardized scripting language which may generate instructions for the call manager 218 and/or broadband residential gateway 300 to execute various functions. The scripting functionality may include the ability to execute an entire call model including interfaces to the signaling system 7 (SS7) 170, public switched telephone network 160, IP network 120, ATM/frame/cell relay network 185, and/or other functions within, for example, IP central station 200 such as the multimedia server 222, announcement server 220, system management server 216, conference server 224, time of day server 212, least cost server 255, and/or domain name server 214.

The call manager 218 may also be configured to maintain the call states for each call it handles (for example, a voice over IP call) and respond to system events created by, for example, the multimedia gateway control protocol (MGCP) messages and/or integrated services digital network user part (ISUP) messages for signaling system 7 (SS7) protocol that may occur during the processing of a call. Exemplary events handled by the call manager 218 include call state changes, call feature changes/call feature triggering events, changes in the status of lines and trunks, and/or error conditions. Further, the call manager 218 may interact with devices connected to a single circuit on the public switched telephone network 160 and/or a device connected to a port of the broadband residential gateway 300. In this manner, new devices may be added to the infrastructure and operate using the open call model contained in the call manager 218.

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The call manager 218 may also include storage for subscriber and network configuration, a cache server for faster access to frequently used data, a routing engine for selecting an appropriate routing algorithm (for example, least cost, best quality of service routing), and/or a service broker which provides the data and logic for specific services. In addition, the call manager 218 may include an authentication (AC) server 245 that provides authentication of various devices, objects, packets and users in the integrated multimedia system. Typically, a user carries a subscriber identity module including preferred terminal configuration data, their identity, personal profile and default qos and call set-up parameter data. In this manner, a user may verify the identity of the calling or called party or the call manager may authenticate a user as a subscriber.

The call manager 218 may interact with the signaling gateway (SG) 234, the accounting gateway (AG) 240, the element management gateway (EMG) 238, the voice gateway (VG) 232, and the multimedia gateway (MG) 230 using any suitable protocol such as IP and an interconnection mechanism such as the central router 210. In one preferred embodiment, the call manager 218 may be configured to utilize signaling messages such as: a) ISUP messages over Common Object Broker Architecture (COBRA) interface to and/or from signaling gateway 234, b) MGCP, SIP—simple internet protocol, H.GCP, and/or other suitable control messages to and/or from the announcement server 220, c) call event records in modified Radius format to the accounting gateway 240, d) Radius (or Enhanced Radius or compatible protocol) control messages to and/or from the voice gateway 232 and/or the broadband residential gateways 140, 300, and e) signaling network management protocol (SNMP) messages to and/or from the element management gateway 238.

The call manager 218 may incorporate one or more databases. For example, the call manager 218 may include database information such as (1) a resources database that provides an identification of what resources are connected to the broadband network 1 and their current state; (2) a trunk/gateway database that indicates which gateway serves what circuits in a trunk; (3) a customer database including a user's personal profile which indicates whether a call is authorized, identifies what services a line supports and determines whether a telephone number is on or off the integrated IP communication network; (4) a numbering plan/least cost routing database which provides routing information that enables the IP central station 200 to choose the correct trunk as a function of the called number; and (5) a local number portability (LNP) database that indicates the North American Numbering Plan (NANP) and associated prefixes which are open for association with the number portability service; and (6) an address of the service control point (SCP) towards which requests for translating these local portability numbers should be routed. The customer profile may comprise a number of the screen portions for a chase me schedule, event calendar, terminal configuration and calling party preference data which all may be likewise a part of memory of the subscriber identity module, carried with the user wherever the user travels.

In exemplary embodiments, the broadband network 1 includes equipment compatible with the COBRA standard. COBRA may be utilized to allow applications from a plurality of vendors to operate with each other. The COBRA standard allows a company, such as AT&T, to build its network using multi-vendor equipment and yet ensure seamless integration and operation. Some of the major areas covered by COBRA v.2.2 includes: Inter-ORB Bridge Support, General Inter-ORB Protocol (GIOP) support, Inter-

net Inter-ORB Protocol (IIOP) support, and Environment Specific Inter-ORB Protocol (ESIOP) support. The call manager 218 may integrate these protocols to facilitate call set-up with diverse equipment. This is advantageous in that equipment from a plurality of vendors may interoperate over the broadband network 1 Without modification.

The multimedia server (MS) 222 may be variously configured. For example, one or more multimedia servers may provide support for multimedia messaging service and/or the overall management of multimedia voice and mail messages transmitted across the broadband network 1. The multimedia server 222 may be configured to support e-mail (for example, html) messages, voice mail (audio) messages, and/or video mail (audio and video) messages. The multimedia server may convert from voice to text, from text to voice, and perform other conversion functions as necessary. The multimedia messages may include standard pre-configured system messages, advertising messages, and/or user defined messages. In either event, where the messages are stored in a centralized location, the multimedia server may provide such storage. Where the multimedia server 222 provides storage for the multimedia messages, a database may be utilized for indexing, storage and retrieval of such messages. In exemplary systems, the user may access predetermined ones of these messages. The multimedia server 222 may utilize IP as a method of communicating with other devices across the broadband network 1.

The conference server (CS) 224 may be configured to provide for multiparty conference calls using, for example, IP voice packets during an IP telephony or multimedia session call (for the latter, the conference server coordinates with the multimedia server). The conference server 224 may include specialized software that runs on a computing platform having associated multiplexing and demultiplexing capability for segregating and aggregating user information packets. For example, the conference server may log several calls into a conference session. When information packets are sent from one or more phones, they are aggregated and sent to the other terminals on the conference call, depending on their capabilities for multimedia transmission and/or reception. The conference server 224 may use any suitable communication protocol such as H.GCP or SIP. The conference server 224 may function to aggregate user information from two or more users onto a single call path. The conference server 224 may include one or more "call-in numbers" and be controlled from any location, for example, a centralized operator location and/or one or more broadband residential gateways 300 or IP central stations. A called party may be added to/deleted from a call and given/denied call privileges in real time in response to user input via the broadband residential gateway and the call manager of the IP central station. It may be desirable to have the conference server 224 configured such that some called parties simply monitor the call without voice interruption while other callers have both voice transmit and receive capabilities. Where a caller is not given the privileges associated with active participation in the call, data packets from these users are discarded. For example, a CEO may have a multimedia conference call with a plurality of financial advisors and invite the press to listen on the call and have multimedia access without interruption capabilities. The resources available for various called parties (high fidelity audio transmission or reception, high definition video transmission or reception, data compression or decompression, encryption or decryption) may be provided at call set up by polling a BRG for terminal configuration information or identification verification of a called party or during a call as it is desired to add a called party to a call.

The gateways in the IP central station 200 may be configured to provide translation of signals to and/or from the various servers in the IP central station 200, the IP network 120, the public switched telephone network 160, the signaling system 7 (SS7) network 170, the Internet 180, and/or the secured management data (SMD) network 190. The gateways typically support one or more of the following group of functions: call processing; signaling system 7 (SS7) connectivity; billing support; OAM&P support; connection to public switched telephone network; control CoS/QoS parameters; and enhanced services.

The voice gateway (VG) 232 may be connected to the public switched telephone network 160 and operate to convert between IP based voice packets and standard public switched telephone network 160 voice traffic. Voice gateway 232 may be configured as multi-frequency (MF) or ISUP gateways on a per-T1 basis. Where multi-frequency (NIF) trunks are used, one embodiment utilizes signaling between the call manager 218 and the voice gateway 232 using MGCP, SIP, H.GCP and/or other compatible protocol. Multi-frequency trunks may be compatible with Feature Group D (FGD), Operator Service (OS) Signaling protocol and/or Termination Protocol (TP).

The IP central station 200 may be variously connected to the public switched telephone network. For example, the IP central station 200 may be connected directly to the public switched telephone network using, for example, a bearer channel (for example, a T1 or T3 carrier) and/or interconnected using one or more networks such as an IP network and/or ATM/frame/cell relay network 185. Where a T1 network is utilized, it may be desirable to utilize one or more of ISUP or MF, FGD, and OS to interconnect a service bureau in the public switched telephone network 160. Alternatively, the service bureau in the public switched telephone network 160 may be interconnected using an alternative network arrangement such as an IP network 120 and/or a ATM/frame/cell relay network 185. The service bureau may coordinate with the IP central station 200 in providing operator services, directory services and provisioning for 311, 611, and 711 services. Emergency 911 services may be routed to an E911 tandem switch that has the appropriate databases and interfaces with a Public Safety Answering Position (PSAP). Emergency 911 services may be coordinated by the call manager 218 and/or public switched telephone network based service bureau.

Voice gateway 232 may be router-based and include one or more voice feature cards and/or DSP Module cards to perform voice processing. The voice gateway 232 may optionally include host processors, LAN/WAN ports, Ethernet ports, T1 or E1 telephony interface cards, Voice Feature Cards with DSP Modules providing voice compression transcoding (G.711 and G.729), carrier-quality echo cancellation with 8 ms-32 ms tail length, a de-jitter buffer which adapts to delay variations in the network in order to minimize the delay, packet loss concealment that generates concealment frames for lost packets using information from previously received data, and/or tone detection and generation. This function detects Multi-Frequency (MF) tones and generates MF and call processing tones (for example, dial tone, call-waiting tone etc.).

In exemplary embodiments, the voice gateway 232 may include T1/E1 interfaces with internal Channel Service Units (CSUs). It may also be desirable to configure the voice gateway 232 such that ISUP, MF and Centralized Attendant Services (CAS) trunks are supported with a configuration done on a per T1 basis. Additionally, multi-frequency tones and Centralized Attendant Services may utilize a "robbed

bits" communication scheme where bits are "robbed" from sub-frames to transmit in-band signaling. The multi-frequency tones may be converted to and/or from, for example, simple gateway control protocol (SGCP) signal requests and events by the voice gateway 232. For example, multi-frequency tones and/or lower level signaling and timing functions may be translated to and/or from any of the following indications: simple gateway control protocol Notify functions, simple gateway control protocol Notification Requests, Connection requests, Modify Connection requests, off-hook and/or on-hook indications.

An Ethernet interface with a RJ-45 connector may be used to connect the voice gateway 232 to the central router 210 (for example, Gigabit Switch or High Speed Router (HSR)). The multimedia gateway control protocol may be used as the interface between the voice gateway 232 and the call manager 218. For example, call control, signaling, and multimedia data stream, real time protocol (RTP) connections, IP addresses, UDP ports, codec choice etc, may be configured in any suitable manner such as by using a multimedia gateway control protocol. In exemplary embodiments, audio streams may be passed directly between customer premises equipment 102 using real time protocol connections over, for example, a user datagram protocol (UDP). Thus, the multimedia gateway control protocol may be utilized to request the voice gateway 232 to initiate, cancel, and/or otherwise modify connections in order to set up and tear down RTP media streams. A similar procedure may also be utilized to request continuity tests and results.

In exemplary embodiments, it may be desirable to adapt the IP network to carry signaling system 7 (SS7) Transaction Capabilities Application Part (TCAP) messages over the IP network 120 and/or the ATM/frame/cell relay network 185. The transport of signaling system 7 (SS7) transaction capabilities application part (TCAP) messages over the packet networks allows signaling operations to be supported by multiple connections to the same host, multiple host connections, and distributed processing of call set-up information using, for example, multiple call managers 218 in the broadband network 1. Thus, the IP network 120 and/or ATM/frame/cell relay network may be utilized to interconnect a plurality of ESS switches to transport signaling information, voice, and/or data. In embodiments where the signaling gateway (SG) 234 is configured to support signaling system 7 (SS7) signaling transport using transaction capabilities application part (TCAP) messages, it may be desirable to include a translator for converting between multimedia gateway control protocol (MGCP) messages and transaction capabilities application part (TCAP) messages and/or ISDN User Part (ISUP) messages.

The point where ISUP and TCAP messages are terminated at a signaling system 7 (SS7) signaling gateway is defined as a Service Switching Point (SSP) to the signaling system 7 (SS7) network 170. The call manager 218 may be configured with a standardized Application Programming Interface (API) to allow interaction with the signaling system 7 (SS7) by, for example, sending and/or receiving ISUP and TCAP messages from a service switching point (SSP). Full class 5 signaling system 7 (SS7) functionality may be included in the call manager 218 including the ability to provide all of the information necessary for billing as defined in the GR-246-Bellcore standard. The signaling gateway 234 may be arranged to perform: signaling system 7 (SS7) message handling (message discrimination, message distribution, and message routing); signaling link management (for example, link activation, deactivation); signaling route management (managing Point Code [PC] route status based on route

received management messages such as Transfer Prohibited, Transfer Allowed, Transfer Restricted, etc.); and signaling traffic management (diversion of traffic based on unavailability, availability, restriction of signaling link, route, and Point Code.) The signaling system 7 (SS7) architecture supports the necessary redundancy component scheme for system reliability and availability during scheduled maintenance and/or software/hardware upgrades. The signaling gateway 234 may be configured to directly provide for lower level signaling system 7 (SS7) processing.

In exemplary embodiments, the signaling gateway 234 interacts with the call manager 218 using an appropriate open interface (for example, Common Object Request Broker Architecture (COBRA)). In these embodiments, it may be desirable for translation software in the signaling gateway 234 to add Message Transfer Part (MTP) layer information to the ISUP and/or TCAP data to create a complete signaling system 7 (SS7) message. The complete signaling system 7 message may then be sent to the Signaling Transfer Point (STP) in the external signaling system 7 (SS7) network 170. Conversely, the signaling gateway 234 may be configured to remove ISUP or TCAP application layer data from the signaling system 7 (SS7) messages received from the STP prior to converting the information to an appropriate open interface (for example, COBRA) and forwarding the information to the call manager 218 via the central router 210.

The accounting gateway (AG) 240 may be configured to receive messages representing events from the call manager 218 via a suitable transport mechanism such as the central router 210. Typically, two messages are received for each call, the first when the call is established, and second when the call terminates. In accordance with the present invention, messages are also generated in real time in response to user input when there is a change, for example, of required bit rate, quality of service, preferred service provider for a segment of the communication or to add/delete parties to a call. In the case of unsuccessful calls, a failure message will be logged. The messages provide details about the calling and called parties, the timing of the call set-up, the duration, the data rate and the quality of service delivered for each segment of the call. Accounting gateway 240 may be duplicated using a redundant computer, with each gateway having dual-mirrored disks. The accounting gateway 240 stores usage records and may then distribute them to linked destinations (for example, billing centers) for processing. Billing centers typically include bill processors that receive accounting information from the accounting gateway 240 and generate appropriate on-line or paper billing to customers. The accounting gateway may be configured to accommodate multiple days worth of accounting records such as the records for one day, two days, three days, four days, a week, or a month. The period in which the data is retained in the accounting gateway may be dependent on business needs, hardware restrictions, and/or the billing cycle. For example, as the end of the billing cycle nears, it may be desirable to shorten the period the accounting gateway holds the data such that calls placed the day the bills are printed are included on the bills. Further, the accounting gateway may both retain and forward data to the billing centers. In this manner, if the equipment at the billing center fails, the accounting gateway 240 may serve as a backup. Similarly, the billing center may act as a backup where the accounting gateway 240 fails.

An Automatic Message Accounting (AMA) format is typically used by circuit-switching systems, packet-switching systems, and other network elements to provide billing usage measurements data (for example, the

Bellcore® Automatic Message Accounting Format (BAF)). This data may be utilized either to permit charging the customer for use of network resources or to permit charging other carriers (for example, InterExchange Carrier (IEC) and other Local Exchange Carrier (LEC)) for assistance in placing or changing characteristics of call connections. The normal AMA format and associated processes may be modified to additionally report time stamped entries and data for actual changes in provided bit rate, quality of service, parties to a communication and/or preferred service provider for billable and non-billable segments of a call; (Internet telephony and usage billing may or may not remain free of charge on a per unit of time basis). The accounting gateway 240 may be configured to convert this information into an Automatic Message Accounting Format (AMA) Format (for example, BAF) records and send these records to the external billing systems using, for example, a TFTP (trivial file transfer protocol). Time-stamp accuracy is typically based on the accuracy of the call manager 218 clock which may be derived from the TOD server 212. To create appropriate AMA records, the event information produced by the call manager 218 preferably has appropriate information for the telephone service specified such as phone number of the calling party (customer), phone number of the called party(s) (customer), time of day of call or any changes, duration of the call or call segments, if more than one network route, bit rate or quality of service is provided for a communication and use of any discretionary features such as conferencing. Different AMA structures may be generated between On-Net calls (defined as within a network service provider IP network 120) vs. Off-Net calls (defined as outside of service provider IP network—for example, public switched telephone network) for billing purposes.

The element management gateway (EMG) 238 may provide system management functionality that includes, for example: a) status and performance monitoring for the Operation Administration, Maintenance, and Provisioning center, to gauge the ongoing operation of applications; b) extensive information exchange with a network operations center responsible for ongoing maintenance of one or more applications; c) customizable operations interface to allow the network operations center to view only information required, thus reducing the time spent filtering information; d) centralize distributed application configuration allowing for the centralized configuration of objects residing on a plurality machines; e) proactive network management capabilities to remove the need for constant operator intervention making the day-to-day operations more efficient; and/or f) intelligent display of status information to separate critical issues from low-priority problems allowing the operation center to assign resources to the right problems at the right time.

The multimedia gateway (MG) 230 may be configured to connect to the public switched telephone network 160 and to convert IP based multimedia packets into standard public switched telephone network 160 traffic. The multimedia gateway 230 may include an intelligent trunking interface that communicates with the call manager 218 for automatic trunk sizing and allocation between the IP network 120 and the public switched telephone network 160. For example, when a system user at the customer premises is using a PC and/or a multimedia phone to communicate with a traditional public switched telephone network 160 user, the communication session involves the transmission of video and audio data. The bandwidth that is required for this type of communication is much greater than that required for a PSTN-to-PSTN voice call or an IP-to-PSTN voice call. The

multimedia gateway 230, as the interface between two systems, may negotiate a larger bandwidth (proportional to data rate) to facilitate the call if the called party is also video enabled. This bandwidth negotiation process typically occurs with a SESS or a Local Digital Switch within the public switched telephone network 160. Typically, a multimedia call, including live video, audio and data, will require greater bandwidth than a voice call supporting a bit rate ranging from 56K to greater than or equal to 1.544 Mbps. However, as the number of users sharing the same link grows, the quality of the transmission deteriorates significantly. The multimedia gateway 230, fully JPEG and MPEG compression/decompression capable, is able to monitor bandwidth (data rate) usage and actual quality of service and make appropriate adjustments so as to maintain a user selected or default quality of service. Further, it may be desirable for the call manager 218 and the multimedia gateway 230 to communicate between themselves and/or the customer premises equipment 102 to determine whether the user has authorized the additional data rate or a higher quality of service and hence expense of the call. For example, even where a called and/or calling party is video enabled, the user may nonetheless refuse to authorize payment for the increased bandwidth necessary for video.

The Internet gateway (IG) 236 may be connected to the Internet (for example, World Wide Web (www)) and provide a means for IP based data packets to be routed between the IP network 120 and the Internet 180. Alternatively, IP based data packets may be routed via the Internet 180. In exemplary embodiments, the Internet gateway 236 routes data-only packets which share the same priority level with other lower priority, non-real-time traffic consistent with computer data communications presently experienced with the Internet 180. Consequently, low priority and low latency data traffic on the IP network 120 utilize the Internet gateway 236 to communicate with other IP data networks such as the www. Voice packets may be routed through another network such as the ATM/frame/cell relay network 185, a private IP network 120, and/or the public switched telephone network 160 where committed information rates may be more easily obtained.

In exemplary embodiments, the broadband network 1 includes the interfaces which enable connections to existing Operation, Maintenance and Provisioning (OAM&P) 195 systems that support, billing, accounting, provisioning and/or configuration management functions. A Secured Management Data (SMD) Network 190 may be utilized to connect the OAM&P 195 to the accounting gateway 240 and element management gateway 238. The Secure Management Data network 190 may include a Network Service Division's NSD Net. The Secure Management Data network 190 helps ensure that only secure communication can occur between the IP central station 200 and the OAM&P 195. This eliminates one potential means of tampering with the billing and provisioning functions in the OAM&P. The billing systems (OSS) 195 may include the Network Operations Center (NOC). The NOC may include a translation server which includes functions for allowing communications and control of diverse networks.

#### B. Broadband Residential Gateway (BRG)

Referring to FIG. 3, a preferred embodiment for a broadband residential gateway (BRG) 300 will now be described and explained. The broadband residential gateway 300 may be configured as the interface unit between the remainder of the customer premise equipment 102 devices and the external network. The broadband residential gateway 300 may be connected to the remainder of the broadband network 1

using any suitable mechanism such as a gateway directly into an IP network and/or a cable connection. In the most preferred embodiments, a hybrid fiber-coaxial plant connection is utilized such as hybrid fiber-coaxial (HFC) plant 112. The hybrid fiber-coaxial plant 112 allows numerous broadband residential gateways 300 to be included on an existing hybrid fiber-coaxial plant 112 without modification to the plant's infrastructure.

The broadband residential gateway 300 may be variously configured to, for example, provide high-speed cable modem capabilities to interconnect one or more associated PCs with each other and with the remainder of the broadband network 1, provide functionality to one or more TVs (using, for example, either an integrated or separate decoder functionality, for example, set top box 350), one or more telephone connections such as plain old telephone service (POTS) phones and/or digital telephones, displays, wireless interfaces, voice processing, remote control interface, display interface, and/or administrative functions. In exemplary embodiments, the broadband residential gateway 300 may a) providing conversion between analog voice and IP voice packets, b) multiplexing/demultiplexing streams of IP voice packets, c) supporting multiplexing/demultiplexing of multiple incoming and outgoing signals including multiple voice, multimedia, data, system administration, and/or TV information signals.

Where the elements of the broadband residential gateway 300 are interconnected, the interconnection may be provided by one or more data buses, for example, a high speed bus (HSB) 360, processor bus 380, and/or other interconnection system. The high speed bus 360, 380 may be configured to provide a flexible conduit for transferring information between the internal hardware, processors and ports. In exemplary embodiments of the broadband residential gateway 300, the high speed bus 360 may include one or more of the following functional units a) a universal remote control receiver module 365 for receiving wireless (for example, infrared, and/or RF) signals (for example, keyboard signals and/or remote control signals) for control of the broadband residential gateway 300 and/or any connected devices, b) a display, display driver, touch screen logic module for driving one or more local and/or remote displays for interfacing with the broadband residential gateway 300 and/or one or more connected devices, c) one or more TV port modules 336 for interconnecting televisions, set-top devices, and/or other audiovisual devices to the broadband residential gateway 300, d) one or more data port modules 334 for connecting/interconnecting data enabled devices (for example, personal computers, palm top devices, etc.), e) one or more telephony port modules 332 for interconnecting one or more analog and/or digital telephones, f) one or more peripheral port modules 342 for interconnecting one or more peripheral devices such as disk drives, data storage devices, video cassette recorders, DVD devices, audio devices, video devices (for example, camcorders, digital cameras, digital video recorders, stereos, etc.), g) one or more external/internal intercom modules 344 for interconnecting remote intercom and/or security monitoring devices, h) one or more wireless interface modules 345 for interconnecting with various wireless extension devices such as wireless TVs, cordless and/or wireless telephones, wireless LANs, etc., i) one or more voice recognition/voice synthesis modules 355 for generating voice announcements, voice messages, and voice prompts and for recognizing voice generated commands and data, i) set-top box module 350 for performing the functions typically associated with a CATV set-top box locally and/or for communicating with one or more remotely

coupled set-top boxes, k) memory 322 (for example, DRAM, RAM, flash, and/or other memory) for storing information and operating data within the broadband residential gateway 300, l) transceiver 302 for communicating with one or more external broadband networks m) operating program store 330 (for example, ROM, flash, etc.) for storing at least portions of the operating programs for the broadband residential gateway 300 and/or interconnected devices, n) security processor, smart card and/or credit card interface module 340 for providing secure processing functions and/or credit card/smart card transaction functions, and/or o) distributed processing controller 306 which may be a microprocessor and/or one or more interconnected distributed processing modules for controlling the broadband residential gateway 300. Where the distributed processing controller 306 includes one or more distributed processing modules, the modules may include a telephony processing module (P1) 308, data processing module (P23) 310, video processing module (P3) 312, auxiliary processing module (P4) 314, IP processing module (P5) 316, and/or an operations administration maintenance and provisioning processing module (P6) 318 interconnected through one or more busses such as processor bus 380. The processor bus 380 and/or high speed bus 360 may include any suitable interconnect bus including intelligent bus configurations incorporating smart buffer logic (not shown in FIG. 3) to facilitate data transfer between interconnected processors and/or modules. The various modules and/or processing components of the broadband residential gateway 300 may be powered by, for example, a power supply unit (not shown). Each of the individual modules of the broadband residential gateway will now be described in more detail.

The transceiver 302 may include circuits for converting digital signals to and from RF signals suitable for transmission across a broadband network such as the hybrid fiber-coaxial plant 112. The transceiver 302 may include one or more input/output ports such as a cable interface (for example, an F connector cable connection) and/or a fiber optic interface connected to a communication media (for example, hybrid fiber-coaxial Plant 112). The transceiver 302 may be compatible with the DOCSIS 1.0 or later specifications. For signaling purposes, the broadband residential gateway 300 may be compatible with the Media Gateway Control Protocol (MGCP) or other compatible signaling protocol (for example, SIP or H.GCP) to support telephony applications. The transceiver 302 may serve as a modem, a translator and/or a multiplexor/demultiplexor. Data received from the network may be de-multiplexed and placed on the data bus for dispatch to the appropriate peripherals and/or ports. Data from the various ports and peripherals may be multiplexed together for distribution over one or more broadband networks (for example, the hybrid fiber-coaxial (HFC) plant 112). Where a hybrid fiber-coaxial plant 112 is utilized, the data may be multiplexed onto various frequency bands of the hybrid fiber-coaxial plant 112 in a continuous data stream(s) and/or packetized data stream(s). To facilitate data transfer for various networks, the transceiver 302 may include one or more registers for data queuing and/or IP tunneling of data packets across the broadband network.

Although the illustration of a display, display drivers, and touch screen logic device 338 suggests that the a display is integral to the broadband residential gateway 300, alternative embodiments of the broadband residential gateway 300 may provide a user interface via the TV screen, PC screen, video telephone, and/or other display device in addition to, or in lieu of, a display integral to the broadband residential gateway 300.

The peripheral ports module 342 may include a plurality of ports providing connectivity to external peripherals. Exemplary interfaces include, PCI, Firewire, USB, DB25, etc. Devices which incorporate one or more of these interfaces may utilize the broadband residential gateway 300 to interconnect to the remainder of the broadband network 1. The exemplary screen portions depicted herein for providing chase me service parameters, event calendars, terminal configurations, alternate routing, bit rate, quality of service, or features may be displayed on any of these display types and user data entry may be collected via various data input means including touchscreen, keyboard, mouse or voice input.

The external/internal Intercom Module (IM) 344 may include one or more microphones/speakers, voice CODECs, telephony processors, and/or interface ports. Where an intercom module 344 is utilized, the built-in circuitry may be configured to detect, for example, unused plain old telephone system telephone(s) and generates a special intercom tone on these unused telephones. In this manner, existing plain old telephone system telephones, digital phones, and/or other devices may serve as an intercom throughout the residence. The controller 306 (for example, such as the P1 telephony processor 308) may function to command the intercom module 344 to determine an appropriate intercom path to select an intercom connection between various locations. In exemplary embodiments, the CODEC may be configured to convert the analog voice signal into IP packets for transmission over one or more data ports 334, TV ports 336, display modules 338, telephony ports 332, peripheral ports 342, external/internal intercom ports 344, wireless interface ports 345, and/or set-top boxes 350.

In yet further embodiments, multiple broadband residential gateways 300 may be configured through, for example, IP tunneling, to set-up an intercom connection between multiple remote broadband residential gateways 300. In this manner, an administrative assistant at the office may be contacted via an intercom connection present at the users home. Thus, one or more individuals disposed at either local and/or remote locations with diverse types of equipment may communicate as an intercom group without the need to communicate via normal dialing procedures.

In addition to intercom services, the intercom module 344 may also configure intercom services for other telephony services (for example, extension transfer, call conferencing, internal caller ID), high speed data services (for example, LAN connections), facsimile transmission/reception, e-mail transmission/reception, video conferencing, and/or CATV/HDTV (Cable Television/High Definition Television) using standard industry protocols such as DOCSIS 1.0 or higher and IP tunneling transmissions. These services are advantageous in that once configured, the user may simulate a work environment in his home.

Though processing may be accomplished by a single processor performing all functions (for example, processing controller 306), in the preferred embodiment shown in FIG. 3, the architecture employs a distributed processing controller 306, and a plurality of processors P1-P6 308-318. In the distributed processing architecture, each of the plurality of processors P1-P6 may be configured to have a dedicated function to provide predetermined services or applications. The processors may be coupled together via any suitable mechanism such as the processor bus 380 and/or high speed bus (HSB) 360. The first processor P1 308 may include telephony applications such as call set-up, call re-routing, qos or data rate changes, call tear down, and other call functions; the second processor P2 310 may include man-

agement functions such as distribution and coordination of data within the various devices of the broadband residential gateway 300; the third processor P3 312 may include video processing functions for configuring control panels, screen displays of attached devices, video conference calls, MPEG decoding functions and other video processing functions; the fourth processor P4 314 may include an auxiliary processor for off loading special processing functions such as numeric processing; the fifth processor P5 316 may include interface input/output processing (for example, text to voice and vice versa) and/or Internet protocol (IP) processing functions for configuring data to communicate with the remainder of the broadband network 1 and/or devices attached to the broadband residential gateway 300 such as IP telephones or IP enable PCs; and the sixth processor P6 318 may include processing functions for Operation, Maintenance and Provisioning (OAM&P) processing. Each of the above processors may be an entirely separate processing unit with included RAM, ROM, Flash memory, or may share RAM, ROM, and/or Flash memory. Where shared RAM, ROM, and/or Flash memory is utilized, the memory may be located within the distributed processor controller 306 and/or on the processor bus 380. Alternatively, the memory may be integrated into the operating program store 330 and/or into memory 322.

The Distributed Processing Controller 306 with its associated processors (P1-P6) may be coupled to the various elements of the broadband residential gateway 300 so as to enable proper operation of each of the individual components. For example, the distributed processing controller 306 (with any associated processors (P1-P6)) may also coupled to the security processor, smart card/credit card, and interface module 340, the peripheral port(s) module 342, and/or the External/Internal Intercom Module 344 for providing control and coordination among devices coupled to the high speed bus 360.

The display 338 may include, for example, an interactive LED/LCD module positioned in a suitable location such as within or attached to the broadband residential gateway 300. The display 338 may include an interface to notify, display and receive user inputs and processing status. The display 338 may be configured to display various informational status and data entry screens and screen portions in a hierarchical tree structure according to expected utilization during call set-up and processing. Status screens may be provided for multimedia mail, called party ID, call logs, call set-up, call in progress and associated information, call waiting information, call conferencing, and/or other call related information. The display 338 may provide a display of real time status of the various devices connected to the broadband residential gateway 300 as well as any current connections, calls, and/or data transfers. The display 338 may also include touch screen capabilities that allow information to be input via a plurality of interrelated on-screen prompts, on-screen icons, and/or a keypad (for example, an alphanumeric keyboard). The keypad may be a remote control, numeric keyboard, and/or alphanumeric keyboard.

In one embodiment of the display 338 operation, a user may touch an icon representing a pending voicemail and/or multimedia mail message. The panel may be configured to send an electronic signal to the processing controller 306 and/or an attached processor such as the telephony processor. On receiving the signal, the P1 telephony processor 308 may be configured to generate an IP packet via the transceiver 302 across portions of the broadband network 1 to the multimedia server 222 in IP central station 200. The multimedia server 222 may authenticate the request by, for

example, verifying the caller with call manager 218 which at call-set-up verifies the location of the request and/or the identity of the requesting party, for example, via a user's SIM card or other secure identification means. Where identity of the calling party is being verified, the user may enter an access password by an audio and/or keyboard request in addition to presenting their SIM card. Where an audio request is generated, the user may utilize the external/internal intercom module 344 of the broadband residential gateway 300, or via a text message entered into the display 338. The user may then enter the appropriate access code via the onscreen soft keypad, microphone, and/or keyboard. Alternatively, the multimedia message could be stored locally in the broadband residential gateway 300 memory 322 and depending on whether there is a password lock on the broadband residential gateway 300, the user may not have to enter a password and insert their SIM card to access the message. Where the message is stored locally in the broadband residential gateway 300 memory 322 rather than IP central station, the display 338 simply recalls the message from memory and presents to the user to provide one-touch instant message retrieval.

In embodiments where the broadband residential gateway 300 supports multiple mailboxes, the icons on the LCD/LED may be personalized to show the identity of the owner of the message. Each user may have a different password to ensure privacy of access. An activity log which tracks past and present messages and/or archived multimedia messages may be presented on display 338. The archive may be stored locally, or at a remote location such as IP central. The archive may be utilized by the user to recall messages which have long since been erased from local storage but may be retrieved from IP central on tape and/or disk storage. This is preferably an optional feature for those users who are less security conscious. The multimedia messages need not be displayed only on display 338. In alternate embodiments, any of the peripheral devices attached to the broadband residential gateway 300 are capable of receiving the multimedia messages.

The memory 322 may be variously configured to include one or more field-upgradeable card slots for permitting memory expansion. Certain users may wish to enable higher end applications such as near video on demand (for example, pausing of shows via buffering in memory), video conferencing of multiple users, multi-party conferences, call waiting for multiple parties, etc. Accordingly, the use of a broadband residential gateway 300 allows the user to upgrade memory via inserting additional cards. Alternatively, the user may use system memory in IP central and buffer data remotely.

Operating program store 330 may be configured to receive updates. This may be accomplished by having the user replace one or more memory cards or automatically by the IP central station downloading new operating code into one or more residential gateways 300.

As previously indicated, smart buffer logic (SBL) may be coupled to the telephony port(s) 332, data port(s) 334, TV port(s) 336, peripheral port(s) 342, and/or the distributed processing controller (DPC) 306. Where the smart buffer logic is utilized, it may function to buffer IP packets for delivery over the communication network such as the hybrid fiber-coaxial plant 112. In addition, the smart buffer logic may include selectable switching and routing algorithms based on services and applications associated with each port. Depending on the destination of the IP traffic, the smart buffer logic may multiplex signal from various devices to effect faster information transfer. The smart buffer logic may

also allow direct memory access between memory 322 and one or more of the devices and/or ports coupled to the high speed bus 360.

The telephony port(s) 332 may include various interface circuitry (for example, analog interface, logic and firmware for interfacing with the Plain Old Telephone (POTs) telephones). Also the telephony port(s) 332 may also be configured to include user interface logic, voice processing logic, voice activity detector logic, voice CODECs, and DTMF (dual tone multi-frequency) tone sensing logic. Echo cancellation and automatic gain control may also be utilized in the telephony port(s) 332 circuitry. In one embodiment, RJ-11 connectors for a plurality of lines (for example, 4) are provided for connection to one or more existing plain old telephone system 110 telephone units. However, the broadband residential gateway 300 may contain any number of telephone connection ports. In this manner, any number of existing user terminals may be connected directly to the broadband residential gateway 300 without modification. Alternatively, the broadband residential gateway can be configured to support, in addition to or as alternative to the plain old telephone system telephone units, ISDN telephones and/or other digital phones (for example, IP telephones) using an appropriate interface.

The data port(s) 334 interface may be variously configured. In one configuration, the data ports include high speed data service connections to, for example, a personal computer (PC) using a LAN connection. For example, the data ports 334 may include an Ethernet 802.3 connection compatible with category 5 unshielded twisted pair (UTP) cable and a RJ-45 connector. The data port(s) 334 may include the necessary interface circuitry for coupling to remote computers.

The TV port(s) 336 may include an interface for conventional television, HDTV and/or CATV services. The TV port(s) 336 typically have one or more F-connectors used for coaxial cable connection to a TV set(s). The TV ports may be configured to connect to a set top box (STB) via the F-connector or directly to a remote television. In embodiments where the settop box is co-located with the television, the data supplied over the TV ports may be either analog and/or digital information. Where the settop box is integrated into and/or comprises the broadband residential gateway 300, the TV ports may be analog or compatible with HDTV signals.

The broadband residential gateway 300 need not necessarily be limited to home use and is intended to also be utilized in business applications. In some configurations, the broadband residential gateway 300 may serve the same functions and operate as a private branch exchange (PBX). Where greater capacity is desired, one or more broadband residential gateways 300 may be disposed on a PC card and combined in a PC, rackmount, and/or server to create an expandable private branch exchange type system that enables intra-premises calling between telephones connected to various telephone connectors on the broadband residential gateway 300.

C. Integrated Broadband IP Based Communication System

FIG. 4 shows an exemplary embodiment of the broadband network 1 shown in FIGS. 1-3, with like components identified with identical numbers. At the extremities of the integrated communications system is the customer premises equipment unit (CPE) 102, for example, one or more customer premise equipment 102 at each customer location. The customer premise equipment 102 may be configured to include an integrated communication interface device such



as the broadband residential gateway 300. Other customer premise equipment 102 devices such as one or more televisions (TV) 106, personal computers (PC) 108, and telephones 110, etc., may be connected to the broadband residential gateway 300 via various ports as discussed above. The customer premise equipment 102 could include multiple TVs 106, telephones 110, and PCs 108 connected to a single and/or multiple broadband residential gateway 300. Further, in certain embodiments, it may be desirable to divide the broadband residential gateway 300 into more than one physical package. In this manner, certain interface circuitry may be located outside of the home while various processing circuitry may be located near a peripheral device such as in a settop.

Where the broadband residential gateway 300 is coupled to the hybrid fiber-coaxial plant 112 in accordance with a preferred embodiment of the present invention, it may be configured to provide the user with both information data (for example, through an Ethernet interface), telephony access, and bidirectional TV service (for example, HDTV, Digital TV and/or CATV services). In exemplary embodiments, the hybrid fiber-coaxial plant 112 typically includes both coaxial cable and optical fiber networks, though, where desired, the network may include only coaxial cable or optical fiber. The hybrid fiber-coaxial plant 112 may be coupled to a head-end hub (HEH) 115. The head end hub 115 may provide an interconnection point to gather and/or transform external services (for example, off air and satellite video, public switched telephone network voice, and Internet data) into a format suitable for distribution on the hybrid fiber-coaxial plant 112 for use with the customer premise equipment 102. The head-end hub 115 may include one or more cable modem termination systems (CMTS) 116 coupled between the hybrid fiber-coaxial plant 112, a Head-end (HE) 117 and/or an Edge Router (ER) 118. The edge router 118 may be coupled to the cable modem termination system 116 and to one or more ultra high speed routers (UHR) 121. One or more ultra high speed routers 121 may be interconnected to each other and/or through a centralized mechanism such as an IP network database to form a high speed network. The high speed packet network 120n is one example of the network 120 (for example, IP network) shown in FIG. 1.

In the embodiment shown in FIG. 4, the high speed network 120n includes the ultra high-speed routers (UHR) 121 configured in a ring configuration. Although this embodiment shows the use of the IP network database (END) 122, other configurations are also suitable. Where an IP network database 122 is utilized, it may be desirable to incorporate one or more data sets such as: a IP local number portability database (IP LNP) 122a which may be utilized for transferring local DN among service providers when a user changes their service provider; an IP caller/user name database (IP CNAME) 122b which may be utilized to provide a database of names relating to IP addresses and/or domain names; an IP line information database (IP LIDB) 122c which may provide alternative billing and allow flexibility in determining who pays for a call; and an IP 1-800 Database (IP 8YY) 122d which may provide a database of 1-800 numbers relating to the IP network 120a. Alternatively, the IP local number portability database may be located at another location, such as at an IP central station (IP Central) 130. Where desired, a local service management system (LSMS) 150 may be arranged to provide management of the IP local number portability database. Where a local service management system 150 is utilized, a plurality of local service order administration (LSOA) units 152 may

be coupled to the local service management system by, for example, a number portability administration center (NPAC) 151. In this manner, directory numbers may be transported among different service providers. In such a case, a NPAC 151 is generally coupled to the LSMS 150 and uses the LSMS 150 to synchronize the numbering databases and to coordinate the porting process.

As indicated above, the broadband network 1 may include a plurality of interconnected high performance networks 120n. Each high performance network 120n may include a separate IP central station 200 and/or share a single IP central station. Having distributed IP central stations located throughout the broadband network 1 provides improved performance and quicker response time for an individual user. Although not illustrated, each high performance network 120. 120n may be connected to multiple head-end hubs 115, each head-end hub 115 may be connected to multiple hybrid fiber-coaxial plants 112, and each hybrid fiber-coaxial plant 112 may be connected to a plurality of customer premises equipment 102, each containing one or more broadband residential gateways 300. The plurality of high performance networks 120n may be configured as an interconnected network for routing packetized information from point-to-point in accordance with a desired destination.

The high performance network 120n may be configured to provide connectivity for and between a plurality of head-end hubs 115 and/or a plurality of broadband residential gateways 300 and other networks such as the Internet, for example, www 180, the public switched telephone network (PSTN) 160 and/or various signaling systems such as the SS7 network 170 for end-to-end voice over IP applications. The IP central station 200 may be configured to provide seamless integration and control of the high performance network 120 (for example, an IP based communication system) interface with the public switched telephone networks (PSTN) 160, signaling system seven (SS7) 170, and/or the Internet 180 so that packetized data, voice calls, and other signaling information is properly transferred between the broadband residential gateway 300 and the public switched telephone network 160 and Internet 180. In certain configurations, the hybrid fiber-coaxial 112, head-end hub 115, and high performance network 120, provide a signal conduit for packetized voice and data which may, with the coordination of the IP central station 200, be provided in the appropriate format between the broadband residential gateway 300, the public switched telephone network 160, and/or the www 180.

#### D. General Operation of Integrated Communication System

The typical home user is currently required to purchase multiple intelligent data conduits such as multiple set-top boxes, a plurality of conventional, DSL and/or ISDN phones, cable modems, HDTV receivers, satellite receivers, home PC LANs, etc. The integrated communication system of the present invention provides a user friendly versatile communication system that enables voice/data (including video) over IP telephony, information data (for example, PC and Internet), television and other high data rate services in a system with one intelligent customer premise equipment 102 interface, the broadband residential gateway 300. The broadband residential gateway 300 in conjunction with the IP central station 200 provides a flexible communication system that can provide any number of integrated communication service features and functions without requiring the user to become familiar with numerous, diverse types of equipment.

In one exemplary application of the voice over IP operations, the broadband residential gateway 300 digitizes



the analog telephony signal using, for example, G.711 $\mu$  law coding (64 Kbps Pulse Code Modulation). The digital samples may then be packetized in, for example, the broadband residential gateway 300 into IP packets. The broadband residential gateway 300 may be configured to encapsulate the IP packets into, for example, DOCSIS (Data Over Cable Service Interface Specifications) frames for transmission back to the head-end hub (HEH) 115 over the hybrid fiber-coaxial plant 112. The hybrid fiber-coaxial plant 112 may then be configured to transport signals for both upstream (to head-end hub 202) and downstream (to the broadband residential gateway 300 and customer premise equipment 102) directions. Although the DOCSIS protocol is utilized in this example, any future protocol may also be used for the digitizing and packeting of data. Where the protocol changes, it may be desirable to download new operating code from, for example, IP central station 200 to the individual broadband residential gateways 300, to update the communication protocols dynamically. When new protocols are adopted, the IP central station may utilize, for example, the system management server 216 to download new protocol data into, for example, the protocol manager in the call manager 218 and the program store 330 in the broadband residential gateway 300.

Where voice packets are sent over constant bit rate (CBR) channels using unsolicited grants, additional packet data channels may be used to support signaling messages (for example, SGCP, Simple Gateway Control Protocol), high-speed cable modem service and/or other upstream packet data services. The upstream packet data services may be sent using available bit rate (ABR) channels such that the voice channels not impacted by data traffic. All services provided herein should be considered together as variable bit rate services because, during a communication, a user may change their data rate requirements in real time in response to user input. For example, during call set-up and even during a communication, a user may specify or respecify their particular data rate requirements to accomplish a given communication segment.

#### 1. TV Signal Transmission/Reception

The head-end 117 may originate CATV signals for transmission over the distribution network. However, in alternate embodiments, signals may be inserted at other points in the distribution network, such as at various hubs or may arise at remote locations in the network such as IP central. Downstream channels may be utilized to facilitate the transmission of signals from the head-end or other input distribution point to the subscriber premise. Where analog RF signals arrive at the broadband residential gateway 300 of the customer premise equipment 102, typically, the transceiver circuitry 302 will detect if the signal is addressed to this broadband residential gateway 300. If so, the transceiver will allow reception of the RF signal. Upon conversion to a digital format, the signal is typically output over the high speed bus (HSB) 360 to one or more associated devices for processing. For example, where the signal is a TV signal, the signal may be output directly to the TV port 336 and/or processed by the settop box 350 prior to outputting to the TV ports 336 and/or display 338. Where user channel selection is preformed directly in the broadband residential gateway 300, channel selection may be preformed by remote control receiver 365 using an external device such as a remote control. The remote control receiver may receive a plurality of individually coded remote control commands from different receivers and process the signals for only one associated device in accordance with the received commands. Alternative channel inputs include the display 338 and/or any associated

keypad. Authorization to certain channels may be controlled by security processor 340.

Where a remote settop box is utilized, the box may be coupled directly to the HFC for individual frequency tuning and/or receive a digital feed from the broadband residential gateway 300 after decoding the digital signal. For example, where hybrid fiber-coaxial plant 112 contains fiber connections to locations near the individual homes, it may be desirable to download one or more simultaneous individually requested programming stream(s) and/or digital data stream(s) to the broadband residential gateway 300. In this manner, the number of channels, movie selections, and/or entertainment options available to the user are unlimited. Cost is minimized since only a single intelligent user interface is used in the home and all televisions, phones, computers, and/or other user interface devices use the same intelligent user interface to the broadband network 1. In this manner, the broadband network 1 may offer premium television, voice and/or data services to multiple conventional televisions, phones, and PCs without the use of multiple set boxes, modems, and external connections. With a vision phone or a personal computer equipped with a microphone and camera connected to the BRG, video telephony and conferencing is possible. Thus, the users are provided a single unified interface to satisfy their external data needs.

#### 2. Exemplary Call Flow of an On-Network Call to an Off-Network Call, with the Off-Network Call initiating the Dropping.

FIG. 5 illustrates an exemplary call processing sequence for an on-net call (for example, an IP based call) to an off-net call (for example, a public switched telephone network based call), in which the off-net party initiates the drop call sequence. Of course, the reverse or alternate routing back and forth among alternative networks may be accomplished as well—IP to circuit-switched back to IP and so on. The exemplary call processing sequence operates as follows:

1. Once the broadband residential gateway 300 detects an off hook condition, the broadband residential gateway 300 may generate an off hook signal 508 to the call manager (CM) 218. The call manager 218 verifies the user's identity by looking for password and SIM card data or other security means, retrieves their user profile, for example, from the card (default qos and other data as well as their identity and preferences) and polls the BRG 300 for the terminal configuration identity that the user is connected through. At the same time, the BRG 300 may advise the call manager 218 of any user entered default or required communication parameters including data rate, quality of service, preferred service provider and the like from the card or a call set-up screen as will be further described herein. The call manager may compare the communication parameters with configuration data and provide an error message to the user if the user may not be able to accomplish a communication as requested. For example, the user may be advised to move to another available terminal connected to the BRG 300. The off hook signal acts as a dial tone request to the call manager 218. Alternatively, the broadband residential gateway 300 may collect all Internet address data or dialed digits (collectively, called party address data) before activating the off hook condition. This alternative may be desirable to save resources at the call manager 218 where multiple incoming lines are available to handle any additional calls. Thus, even though one phone is off-hook, the broadband residential gateway 300 deter-

mines that other lines are available and does not initiate the off-hook signal until all called party address data have been collected.

2. Where the call is managed by the call manager, the call manager 218 will issue a dial tone message 509 to the requesting broadband residential gateway 300 in order for the broadband residential gateway 300 to generate a dial tone to the associated phone. Where the broadband residential gateway 300 shares management of the call, the broadband residential gateway 300 generates the dial tone in response to the off-hook condition.
3. Where the call is managed by the call manager 218, the call manager 218 will then enter a state where it polls and collects the dialed digits 510 from the broadband residential gateway 300. The called party address data including Internet address or dialed digits may then be transferred to the call manager 218 one at a time as they are entered. Alternatively, where the call set-up control process is shared between the broadband residential gateway 300 and the call manager 218, the broadband residential gateway 300 collects the called party address data and transfers these, together with the off-hook signal to the call manager 218. This transfer may be facilitated by combining the called party address data with other data into a single or multiple data packets as necessary.
4. On receiving the called party address data, the call manager 218 will determine if translation of called party address data is required and, if so, perform the translation. For example, the call manager may determine whether local number portability has been enabled. Where local number portability has been enabled, the call manager 218 may issue a local number portability (LNP) query 511 to the IP local number portability database 122. The IP local number portability database 122 may then supply the call manager 218 with a routing number 512 if the called party address data form a valid sequence. Where the called party address data do not form a valid sequence, the call manager 218 will return an error indication to the broadband residential gateway 300. The error designation may include a tone and/or a more detailed error message for display on, for example, display 338.
5. Where the call sequence is valid, the call manager 218 may issue a first call proceeding message 513 to the broadband residential gateway 300 indicating that the number is valid and the call is proceeding (for example, a valid on-hook condition).
6. Next, the call manager 218 typically determines whether adequate network resources are available to carry the call by comparing the communication requirements (default requirements or specified requirements) to the network resources and determining least cost routing via least cost route server 255 and alternative network paths in priority order. These are displayed to the user as discussed further herein. The call manager also involves the multimedia server and conference server as necessary. The call manager 218 also polls a BRG associated with the called party to determine if their resources are adequate to complete the communication as requested by retrieving the called party's terminal configuration data. Error messages may be provide to the user if there exists a mismatch between call set-up requirements and called party terminal configuration. In embodiments where the broadband residential gateway 300 is connected to a hybrid fiber-

coaxial plant 112, the call manager 218 may send an open gate allocation request 514 to the cable modem transmission system 116. In this event, it is often desirable for the cable modem transmission system 116 to provide a gate allocation acknowledgement 515. A gate allocation acknowledgement may be utilized to verify that the necessary gate and any alternative gate resources have been allocated.

7. The call manager 218 may send an open connection request 516 to the voice gateway (VG) 232 in order to provision the connection. Once the connection is provisioned, the VG 232 may provide an open connection acknowledgement 517 back to the call manager 218.
8. For off network connections, it is often necessary to enter a second phase of the connection process involving the appropriate link signaling to establish a call. For example, the call manager 218 may send an ISUP IAM (Initial Address) message 518 containing the directory number (DN) of the called party(s) to the signaling gateway (SG) 234 and conference server 224 as necessary. This process is often utilized to allocate the appropriate voice trunk for communication. The call manager 218 may also send an alerting message 519 to the broadband residential gateway to produce an alerting signal, for example, an audible ringing tone to the user terminal. The signaling gateway 234 may make the appropriate connections when the trunk has been allocated and acknowledge the request with an ISUP A call manager (Address Complete) message 520.
9. Once the called party has answered the call and connection is established, the signaling gateway 234 may send an ISUP ANM (Answered) message 521 to the call manager 218 indicating that the called party has answered.
10. The call manager 218 may then send a time/date-stamped call start message 522 to the accounting gateway (AG) 240, indicating the start of the call. The AG 240 may use this information for billing purposes.
11. At this point the link has been established and a conversation 523 can proceed over the communications path. Note that although signaling system 7 (SS7) signaling is used herein to illustrate the present invention and is a well known signaling protocol utilized in the art of telephony telecommunication, the instant invention is not limited to the use of signaling system 7 (SS7) signaling for call establishment of an off-network call; the use of signaling system 7 (SS7) signaling is merely illustrative. As such, other methods of signaling may be substituted for signaling system 7 (SS7).

A user may change call parameters in real time by entering new requirements (chase me schedules, event calendars, calling party preference data, data rate, quality of service and the like) during a communication. For example, the user may request a greater data rate to play a home video or sequence of digital images to the called party. Steps 1-11 then are repeated to assure the availability of network and called party resources. Any such change may involve a billing change and a date/time stamped call progress change message is sent to the accounting gateway 240 to document the change. Also, periodically during a call, the actual quality of service and data rate may be forwarded by the call manager 218 to the accounting gateway 240.

12. When the called public switched telephone network user terminates the link, an on hook signal may be sent

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to the appropriate public switched telephone network switch, such as a 5ESS. The signaling network may then send a call termination message (not shown) to the signaling gateway 234 as notification of the call termination status.

13. The signaling gateway 234 may then generate a release 524 signal to the call manager 218.
  14. Upon receipt of the release 524 signal, the call manager 218 may a) initiate the relinquishment of the provisioned network resources by issuing a close connection 525 message to the voice gateway (VG) 232 and a release complete 526 message to the signaling gateway 234, b) inform the accounting gateway that the call has been terminated, for billing purposes via, for example, sending a time/date stamped call end 527 message to the accounting gateway 240.
  15. With reference to the close connection 525 message, the voice gateway may respond by issuing a report message 528 to the call manager 218 containing the current status of the call.
  16. On receiving the call status report 528, the call manager 218 may issue a delete connection 529 message to the broadband residential gateway 300.
  17. The broadband residential gateway 300 may then release its resources and sends a status report 530 to the call manager 218. In addition to the report 530, the broadband residential gateway 300 may also send an on hook 531 status report to the call manager 218.
  18. The call manager 218 may then inform the broadband residential gateway 300 to report the next off hook condition via message 532.
  19. Where a cable modem transmission system is utilized, the call manager 218 may then issue a release gate 533 message to the cable modem transmission system 116 so that all the modem resources can be relinquished. Once the gate resources have been released, the cable modem transmission system 118 sends a release gate complete 534 message to the call manager 218. At this point, all resources pertaining to the call have been relinquished.
- Communications may involve call set-up parameters or call change parameters involving a user selected higher data rate and quality of service as discussed above. It is also contemplated by the present invention to change a preferred long distance carrier in real time in response to user inputs. The call manager 218 may initiate a change in preferred service provider via the accounting gateway 240 which organizes and controls a negotiation between preferred service providers in real time. The service providers, for example, may share their subscriber billing data and collect the electronic signature of the user who authorized the change. For example, AT&T may negotiate a change to MCI during a call and a subscriber may receive bills for the same call whereby a first call segment is billed by one service provider and a second call segment is billed by the other newer preferred service provider.

### 3. Exemplary Call Flow of an On-Network Call to another On-Network User, Under One Call Manager Control

FIG. 6 illustrates an exemplary call flow of an on-network call to another on-network user, with the call being handled by a single call manager (CM) 218. In alternate embodiments, different portions of the call set-up sequence may be handled by more than one call manager 218 in the IP network 120. The exemplary "on-network" call processing sequence operates as follows:

1. Once the broadband residential gateway 300A detects an off hook condition of, for example, a user terminal,

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the broadband residential gateway 300A may generate an off hook signal 607 to the call manager (CM) 218. The off hook signal may act as a dial tone request to the call manager 218. As above, the call manager verifies subscriber/user identity and collects call set-up and terminal configuration data.

2. The call manager 218 may then issue a dial tone message 608 to the requesting near-side broadband residential gateway 300A in order for the broadband residential gateway 300A to generate a dial tone.
3. The call manager 218 may then enter a state where it polls and collects the called party address data including Internet address or dialed digits 609 from broadband residential gateway 300A. The dialed digits are transferred to the call manager 218 one at a time. In a similar fashion to the subject matter discussed above, in embodiments where the call setup is shared between the call manager 218 and the broadband residential gateway 300A, the broadband residential gateway may manage the call set-up and transfer both the off-hook signal and the dialed digits to the call manager 218 within one or more data packets.
4. On receiving the completed dialed digits, the call manager 218 may perform necessary translation as described above, for example, by issuing a local number portability query 610 to the IP local number portability database 122. The IP local number portability database 122 may then supply the call manager 218 with a routing number 611 if the dialed digits constitute a valid sequence.
5. The call manager 218 may then ensure that adequate network resources and calling party and called party's terminal configuration are available and appropriate to accommodate the call.
6. Where adequate resources are available, the call manager 218 may issue a first setup message 612 to whatever mechanism couples the far side broadband residential gateway 300, for example the cable modem transmission system 116B, to allocate transmission resources on the far side.
7. A call proceeding message and a report on hook condition message 613 may then be sent to the broadband residential gateway 300A.
8. A gate allocation message 614 may then be sent from the call manager 218 to the cable modem transmission system 116A, where the broadband residential gateway 300A is coupled via a cable modem transmission system. In this environment, a gate allocation 614 message may be utilized to set up the relevant modem resources.
9. Where a cable modem transmission system is utilized and receives the setup message 612 from call manager 218, the cable modem transmission system 116B may then send a connection request 615 message to the far side broadband residential gateway 300B.
10. Where a cable modem transmission system 116B is utilized, the cable modem transmission system may then send a setup acknowledgement 616 to call manager 218. Once the resources are allocated by the cable modem transmission system 116A, the cable modem transmission system may then send a gate allocation acknowledgement message 617 back to the call manager 218.
11. Once the call manager 218 receives the setup acknowledgement 616 along with the gate allocation

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acknowledgement message 617, the far-side broadband residential gateway 300B may then send a ringing message 618 to the far-side cable modem transmission system 116B where this connectivity is utilized.

12. In these embodiments, the far-side cable modem transmission system 116B may then issue an alerting message 619 to the call manager 218.
13. The call manager 218 may then convey the alert via an alerting message 620 to the broadband residential gateway 300A, to produce a indicating signal such as a ringing signal indicating that the call is going through.
14. The cable modem transmission system 116B may then issue a connect message 622 to the call manager 218 in response to the far-side broadband residential gateway 300B sending an off hook message 621 to the far-side cable modem transmission system 116B. At this point, an end-to-end communication path is established and conversation 623 can be facilitated. QoS and data rate monitoring begins and are reported to a user via their display as will be described further herein via call manager 218.
15. Assuming that the calling party hangs up first, the broadband residential gateway 300A may initiate an on hook sequence 624 message which may be communicated to the near-side cable modem transmission system 116A.
16. The cable modem transmission system 116A may then issue a disconnect message 625 to the call manager (CM) 218. The call manager 218 may then issue a first delete connection request 626 to the near-side broadband residential gateway 300A and then a second delete connection request 627 to the far-side broadband residential gateway 300B.
17. The near-side broadband residential gateway 300A may respond to the call manager 218 with a report message 628 containing the connection status, as well as an on hook message 630 to verify that the calling party at near-side broadband residential gateway 300A has terminated the call.
18. The far-side broadband residential gateway 300B may respond to the call manager 218 with a report message 629 containing the connection status, as well as an on hook message 631 indicating that the called party connection has now been terminated.
19. At this point, the call manager 218 may issue release gate messages 634 and 635 to the near-side cable modem transmission system 218 and far side cable modem transmission system 116B, respectively, so as to release the modems associated with the call. Once all the resources have releases, the cable modem transmission system 116A and the cable modem transmission system 116B may issue gate release complete messages 636 and 637 respectively to the call manager 218.
20. For simplicity, the accounting processing is not shown. However, the process used in FIG. 5 may be utilized as a billing procedure for on-net calls. Such a process might constitute sending a time/date-stamped call start message from the call manager 218 to an accounting gateway (AG) 240 after the connect message 622 is sent from the far-side cable modem transmission system 116B to call manager 218. The call start message, containing initial data rate, preferred service provider and quality of service data, would trigger the start of the billing procedure. Call change messages, as described above, may be initiated by the calling party. Assuming no changes as discussed above, a corre-

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sponding date/time stamped call end message providing ending data rate and quality of service data may then be sent from the call manager 218 to the AG 240 after the near-side cable modem transmission system 116A sends a disconnect message 625 to the call manager 218. This call end message may trigger the ending of the billing procedure for that call.

Although the IP voice packets for these calls are typically routed over the IP network 120, the system may, where appropriate, route IP voice packets over the Internet 180.

## II. A Chase Me System for IP Broadband Subscribers

Now a method of chasing IP broadband subscribers and of locating them to receive, for example, a multimedia communication or a conference call will be described in some detail with reference to FIGS. 7-11. FIG. 7 is a collection of screen portions which may comprise screens displayed on displays to users of the present invention such as call set up screens, call progress screens and alternative call routing screens.

- FIG. 7(a) is a representative screen portion whereby a user may select and/or the screen portion may display a chase me schedule. In the depicted embodiment, a user is provided with an opportunity to identify an Address for an IP or telephone communication and details of a schedule for receiving communications at that address. While only the Address is shown in the table, other screen portions may be used as necessary for storage as subscriber profile information on a SIM module, at BRG memory or in memory at the IP Central Station which permit correlation of the address with a location address such as a number and street address, city and state. The user may use their mouse (or utilize a voice response system in an alternative embodiment) to move the desired position from entry to entry as appropriate and as they complete an entry. Other entries include Time of Day and Days of Week and other data not shown which may likewise be entered. For example, a user may have a telephone number and an IP address for both work and home and a wireless telephone number and a pager number and personal identification code for commuting from the home to office and during travel. Since the BRG may parallel process and initiate communications in parallel, the BRG may initiate both the work phone and IP addresses simultaneously. Moreover, the BRG may initiate a first priority address such as a work address simultaneously with another address such as the wireless address and the paging address, especially when the time of day may be a time when the subscriber is likely just arriving at work and may be in his car to answer a wireless call, walking to work to answer a page or at his desk to take the communication at his personal computer or telephone. Moreover, the BRG may learn and the data of FIG. 7(a) should be considered initial or default data. After successfully reaching a subscriber at a terminal, the BRG may learn over time, for example, that the subscriber leaves for work at 8:10 AM and not 8:00 AM. The data, which may be considered personal profile data, may be stored on the SIM module that the subscriber carries with them from terminal configuration to terminal configuration.

Not shown in FIG. 7(a) is a follow me set of parameters. As discussed in copending and concurrently filed patent applications of the same inventor, follow-me parameters relate to the entry of temporary information input by a user when the user, for example, is traveling on business. The user may access BRG or IP Central Station memory by dialing a toll-free number or via a web site and enter the telephone number or IP address where they may be reached, for example, at a hotel or restaurant or other travel location. Then, the input information would be restrictive as to date

and time of day. For example, the user may only be reached at the Biltmore Hotel between the hours of 12:00 noon and 10:00 PM on a given day. Follow me parameters, if existent, take precedence over chase me parameters whenever there is a conflict.

FIG. 7(b) is a representative screen portion whereby a user may select and/or the screen portion may display a personal event calendar for reminder and multimedia messaging purposes. The column titles suggested are merely exemplary and can be otherwise named or ordered in a given screen display. The first column is event, for example, Christmas, December 25. A user may identify their Christmas card list under the column Address and an appropriate multimedia Christmas greeting under the column Message that may be scheduled for delivery at a given Time of Day on Christmas day (Date). Other greetings may be predetermined and stored such as for other holidays, Mother's Day and/or other important days such as mom's birthday.

A more typical use of FIG. 7(b) is for event calendar reminders. For example, there may be a meeting with the boss from 9:00–10:00 AM on March 25. There may be a social event such as junior's appearance in a school play on March 24 from 8:00 until 11:00 PM. The chase me system may chase the user according to the event calendar reminder and deliver reminders to the user at an automatically calculated or predetermined periodic schedule in advance of the meeting or event.

FIG. 8 is one embodiment of a screen or a screen portion for displaying actual and alternative calling party preference data for a given communication to a first called party or user which may be a part of a call set-up screen or a terminal configuration screen that is stored on a user's SIM card or in BRG or Central Station memory. For a second or more called party user(s), there may be associated screens and/or screen portions for the other called parties. The user may select for Mom, a high preference level 1 and identify the caller by their telephone number or IP web address mom@www.com, which according to translation data, may also represent their premises location or, if only a web site or area code area specified, the general serving area of area code and web site. Dad may likewise have a high preference level of 1. Friend may have a slightly lower level, 2, and Boss a high level of 1.

Referring to FIG. 10, a table indicating the preference levels and exemplary instruction sets is shown. Level 1 may represent an indication that the called party user is willing to be located wherever they are and desires to take the call or even allow the caller to barge in on a present call or communication. Level 2 may represent every feature in level one except barge-in. Level 2 includes chase me, follow me. Level 3 may represent no chase me, follow me or call forwarding process. It suggests, announce the call to the user and the user will decide whether to take the call. Level 4 may represent a communication that is to be permitted the opportunity to take a message only—there is no announcement or alerting of the user/subscriber of the communication. Level 5 is a filtered call that the called party refuses to accept. The calling party will not even be allowed the opportunity to leave a message in level 5. These levels are merely representative of the calling party preference levels. One additional level may be a level where a chase me, follow me call is announced to a user but there is no concurrent indication to the user that the system is chasing or following the user so that the called party user may not feel as obligated to take the call. The call instruction set that attaches to the calling party may be appropriately modified according to time of day, day of week and the like. For

example, the user may be willing to accept calls from their daughter traveling in Europe at any time of the day even between 8:00 PM and 8:00 AM but calls from the boss only between the hours of 8:00 AM and 8:00 PM.

FIG. 9 is a collection of screen portions which may comprise screens for terminal configuration. These screens are intended to supplement the data that a broadband residential gateway may automatically collect from a given terminal from polling the terminal, for example, the BIOS of a personal computer. All terminal configuration data may be maintained in memory at the gateway and provided to the IP central station when needed. By way of example, terminal number 1 may be a personal computer, a laptop, manufactured by Toshiba of Japan having given hardware characteristics and driver capabilities for peripherals. It also has installed software and plug-ins. It finally has bit rate and data handling capabilities as defined by its interface to the network. For example, if the personal computer is linked via an appropriate cable modem to the network via the broadband residential gateway, it will have maximum bit rate capability. Other examples shown include a set top terminal/television which may have high definition television display capabilities, an internet telephone and an internet vision-phone station. If a given terminal does not have plug-ins, software and the like necessary to accept a given multimedia call, the gateway may arrange to obtain the missing plug-in or software in real time as the caller and user are conducting a communication. Sample plug-ins that may be used during a multimedia call include plug-ins for MPEG or JPEG compression/decompression or encryption. Dolby stereo, Apple QTVR and the like. These may be obtained on a pay-per-use, free, pay per unit of time or other pay or free basis in real time in response to the user's request. Once the plug-in is obtained and installed, one or both parties may be alerted to the new capability.

Now an example of remote chase me/follow me and terminal configuration parameter set-up will be discussed. The user has left their premises and may be located at a telephone terminal or a web-equipped terminal. The user dials a number such as a toll-free number or inputs a web site address that may be directly associated with their IP central station 200. The IP central station may provide an appropriate Internet page menu for accessing chase me/follow me and terminal configuration selection options or the announcement server may provide a similar audible menu. The screen portions may be similar to those of FIGS. 7–10. The user may use their subscriber identity module, enter passwords or otherwise identify themselves for validation as a subscriber. The subscriber will then receive an indication that they have been validated. Working through various combinations of screen portion including but not limited to those depicted, the user may select or change 1) their calendar of events or message address lists or any other parameter of FIG. 8 for any associated terminal of a gateway 300, 2) change or add to their calling party preference instructions of FIG. 10, 3) change terminal configuration data for a terminal associated with gateway 300 per FIG. 9, or 4) change their chase me or follow me or call forwarding function or data per FIG. 7 or perform other functions remotely from an internet terminal or telephone terminal.

Now some examples of some predetermined chase me features will be discussed. A first example will be a daughter traveling in Europe, calling home from a telephone. The calling telephone will have an associated country code and city code. The subscriber cannot tell exactly what telephone his daughter will call in from but the subscriber may enter a combination of country codes or country codes in combi-

nation with city codes into a calling party preference table such as FIG. 8. Moreover, the subscriber may predetermine the daughter's preference level as level 1 and that the daughter may call at any time during the day.

Now the daughter may call at six o'clock, and the family may be asleep because 6:00 PM in Europe corresponds to 12:00 midnight—Eastern standard time. The daughter may be informed via announcement server 220 1) the family is asleep, 2) her father is at home, 3) the system will attempt to alert her father only or 4) would she want to leave a message in stead or wait. The father, sleeping in the bedroom, may be alerted via a tactile alerting means as a first priority or by audible distinctive ringing as a second alternative. A third alternative may be an audible announcement of his daughter's call—that the call is from his daughter and he may take the call at the nearest telephone of his choice.

If the father never answers the telephone, the daughter will be continuously given the option of leaving a message. If the father answers the phone, the father may be given a display of the telephone number or Internet address that the daughter is calling from and the location of the telephone and any other information provided by the originating international service provider; (time-of day, temperature, weather, call set-up and terminal configuration data and the like may be provided).

If the father is using the telephone, the daughter will have barge-in privileges to the communication because of her status as level 1 and may be given the opportunity to leave a message or use those privileges. If the daughter calls the father at his office and the father is not at his office, the communication may be forwarded and the communication identified as a chasing call. A chasing bit may be set at this time and the father and daughter alerted that the call is a chasing call. Similarly, if the call is for the father and the father is not home, the call will be identified as a chasing call and the call forwarded to number according to the chase me/follow me parameters of FIG. 7a. Also, in this situation, the daughter may be advised that her mother is at home and rather than chase the father, would she like to wake her mother to take the call.

Another example may be a multimedia business call forwarded from the user's office. Again, the call is recognized as a chasing call and the chasing bit set so that the called party and calling party may be appropriately alerted that the system is in a chasing mode. The calling party may have been already alerted that the user was not at their office and is willing to take the call at home (the caller may have a priority level 2, no barge-in, but chase me, follow me privileges). The subscriber is located as being at his swimming pool and carrying his remote control or wireless alerter for example, by surveillance or camera or voice recognition or other input. The caller may be told that the call is a chasing call, that the called party is at home and would the caller like to wait while the called party is alerted to the call and advised of a terminal to accept the communication. Meanwhile, the called party is alerted via distinctive ringing or other alerting means that a chasing call is for them and/or advised via their remote control or wireless alerter if the unit is equipped with a display, or a speaker at the pool or other terminal at the pool that the called party should take the multimedia call at their personal computer in their office.

Another example introduced in concurrently filed patent applications for remote monitoring (IDS 1999-0286) and alerting describe emergency reporting services. In a fire or burglar alarm reporting scenario, agencies are typically reluctant to act for two reasons: 1) there is a high incidence of false alarms and 2) the premises owner cannot be notified

and questioned. These concerns are alleviated at the time of an emergency reporting call if the subscriber may be chased or followed. A conference call may be established among the agency, the BRG and the subscriber. The BRG may automatically report: there is a fire in the kitchen as determined by smoke detector, the temperature in the room exceeding normal temperature, the camera spotting smoke or another change in normal reporting (motion detection) or audible detection of something wrong. The subscriber and agency may both listen to the announcement and discuss permissive actions that may be taken in a conference communication via the multimedia server and conference server.

The final example that will be discussed is a paging example. When the IP telephony user is away from the location of their BRG and in areas where the user can only be reached by paging service the user can set up his chase me/follow me schedule in such a way that, when there is an incoming call during the given time period, the calling party will be greeted with the user's predetermined prompt. It is well-known, for example, that a satellite paging system may reach users in many locations that are otherwise presently inaccessible such as on airplanes, in basements, on mountain expeditions, deserts, almost anywhere on earth, because the system is highly penetrating. On pressing relevant options, the calling party may dictate an entire message on the BRG for the user. The BRG on receipt of the dictated message will initiate an IP data call to a paging operations server on its IP network, transcribing the entire audio message into text format ready to be sent out as an alphanumeric paging message to the user. In particular, the message may be transmitted as a text attachment to a control message e-mail to the paging server. Then, the paging server separates the text attachment from the control message and transmit the text as a paging message to appear on the user's pager. A successful delivery message may be announced or otherwise delivered to the calling party.

FIG. 11 is an example of one embodiment of a screen portion of one call set-up screen whereby a call manager may report to a broadband gateway at a user location on the characteristics of a calling party configuration including their location, terminal resources and network resources so that terminal resources in the event of a multimedia call may be matched as closely as possible between a calling party and a called party. As described above, the call manager preferably compares terminal configuration data for a calling party user and for a called party user with a desired call set-up parameter set entered by the user to determine if the communication can occur as desired and provides an error message if there exists a mismatch. Additionally, if the mismatch can be overcome by simply arranging for the downloading of software and assuming hardware deficits cannot be overcome, the calling or called party user can be alerted to move to an appropriate terminal and that a download of software functionality has been initiated so that the multimedia call can occur.

The following copending U.S. Patent applications, originally filed the same day as the present application, are hereby incorporated by reference:

1. U.S. patent application Ser. No. 09/475,167, entitled "Automatic Port Status Reporting and Selective Call Barge-in For a Broadband Voice Over IP Telephony System and Method" invented by Kung et al.
2. U.S. patent application Ser. No. 09/475,140, entitled "Automatic Cable Phone Service Activation," invented by Kung et al.
3. U.S. patent application Ser. No. 09/475,141, entitled "Broadband Cable Telephony Network Architecture IP

- ITN Network Architecture Reference Model," invented by Kung et al.
4. U.S. patent application Ser. No. 09/475,142, entitled "IP Conference Call Waiting" invented by Kung et al.
  5. U.S. patent application Ser. No. 09/475,143, entitled "Conference Server for Automatic X-Way Call Port Expansion Feature", invented by Kung et al.
  6. U.S. patent application Ser. No. 09/475,197, entitled "Wireless Touch Screen Television," invented by Kung et al.
  7. U.S. patent application Ser. No. 09/475,195, entitled "Programmable Feature Buttons on a Broadband Residential Gateway," invented by Kung et al.
  8. U.S. patent application Ser. No. 09/475,745, entitled "Automatic Call Manager Traffic Gate Feature," invented by Kung et al.
  9. U.S. patent application Ser. No. 09/475,201, entitled "Local Number Portability Database for On-net IP Call," invented by Kung et al.
  10. U.S. patent application Ser. No. 09/475,747, entitled "Personal IP Follow Me Service," invented by Kung et al.
  11. U.S. patent application Ser. No. 09/475,194, entitled "Personal IP Toll-Free Number," invented by Kung et al.
  12. U.S. patent application Ser. No. 09/475,196, entitled "User Programmable Port Hunting in an IP Based Customer Premise Equipment," invented by Kung et al.
  13. U.S. patent application Ser. No. 09/475,146, entitled "IP Leased Line," invented by Kung et al.
  14. U.S. patent application Ser. No. 09/475,160, entitled "Anonymous Call Rejection," invented by Kung et al.
  15. U.S. patent application Ser. No. 09/475,161, entitled "Automatic Callback With Distinctive Ringing," invented by Kung et al.
  16. U.S. patent application Ser. No. 09/475,162, entitled "IP Multimedia Call Blocking," invented by Kung et al.
  17. U.S. patent application Ser. No. 09/475,144, entitled "IP Call Forward Profile," invented by Kung et al.
  18. U.S. patent application Ser. No. 09/475,671, entitled "IP Call Forward Follow Me," invented by Kung et al.
  19. U.S. patent application Ser. No. 09/475,670, entitled "Enhanced BRG with Display Capabilities," invented by Kung et al.
  20. U.S. patent application Ser. No. 09/475,672, entitled "Hand Held Integrated IP Device," invented by Kung et al.
  21. U.S. patent application Ser. No. 09/475,292, entitled "Wireless Settop Box," invented by Walker et al.
  22. U.S. patent application Ser. No. 09/475,145, entitled "BRG PCMCIA Card Cable Ready for PCs," invented by Kung et al.
  23. U.S. patent application Ser. No. 09/476,494, entitled "Broadband Service Access," invented by Kung et al.
  24. U.S. patent application Ser. No. 09/475,798, entitled "Method for Providing Broadband Public IP Services," invented by Kung et al.
  25. U.S. patent application Ser. No. 09/475,797, entitled "Method For Billing IP Broadband Subscribers," invented by Kung et al.
  26. U.S. patent application Ser. No. 09/475,165, entitled "BRG With PBX Capabilities," invented by Kung et al.
  27. U.S. patent application Ser. No. 09/475,783, entitled "Enhanced IP Subscriber Alerting," invented by Kung et al.
  28. U.S. patent application Ser. No. 09/475,673, entitled "Call Hold With Reminder and Information Push," invented by Kung et al.
  29. U.S. patent application Ser. No. 09/475,293, entitled "Activity Log For Improved Call Efficiency," invented by Kung et al.

30. U.S. patent application Ser. No. 09/475,779, entitled "Selective Information Admission," invented by Kung et al.
  31. U.S. patent application Ser. No. 09/475,166, entitled "User Programmable Fail-proof IP Hotline/Warm-line," invented by Kung et al.
  32. U.S. patent application Ser. No. 09/476,493, entitled "Authentication of Broadband IP Telephony Service," invented by Kung et al.
  33. U.S. patent application Ser. No. 09/475,667, entitled "Simplified IP Service Control," invented by Kung et al.
  34. U.S. patent application Ser. No. 09/475,206, entitled "Personal Control of Address Assignment & Greeting Options for Multiple BRG Ports," invented by Kung et al.
  35. U.S. patent application Ser. No. 09/475,661, entitled "Protected IP Telephony Calls Using Encryption (P.I.E-Protected IP Encryption)," invented by Kung et al.
  36. U.S. patent application Ser. No. 09/475,294, entitled "Integrated Multimedia Messaging Service," invented by Kung et al.
  37. U.S. patent application Ser. No. 09/475,666, entitled "Remote Monitoring Through the BRG," invented by Kung et al.
  38. U.S. patent application Ser. No. 09/475,296, entitled "Cable Headend System with Pseudo-Switching Capabilities," invented by Kung et al.
  39. U.S. patent application Ser. No. 09/475,287, entitled "A Method for Performing Roaming Across Multiple IP networks," invented by Kung et al.
  40. U.S. patent application Ser. No. 09/475,662, entitled "Scalable VoIP network Server For Low Cost PBX," invented by Kung et al.
  41. U.S. patent application Ser. No. 09/475,288, entitled "Call Services Transfer," invented by Kung et al.
  42. U.S. patent application Ser. No. 09/475,204, entitled "Multiple Call Waiting in a Packetized Communication System," invented by Kung et al.
  43. U.S. patent application Ser. No. 09/475,205, entitled "Optimizing Voice Paths in an IP Telephony Network," invented by Kung et al.
  44. U.S. patent application Ser. No. 09/475,203, entitled "Call Waiting and Forwarding in a Packetized Communication System," invented by Kung et al.
  45. U.S. patent application Ser. No. 09/475,202, entitled "Incoming Call Identification in IP Telephony," invented by Kung et al.
  46. U.S. patent application Ser. No. 09/475,290, entitled "Incoming IP Call Remote Party Data," invented by Kung et al.
  47. U.S. patent application Ser. No. 09/475,295, entitled "Personal User Network (Closed User Network) PUN, CUN," invented by Kung et al.
  48. U.S. patent application Ser. No. 09/475,668, entitled "IP Address Interworking Unit (IAIU) For Automatic IP V4 to V6 Address Translation," invented by Kung et al.
  49. U.S. patent application Ser. No. 09/475,669, entitled "Automatic Off-Hook Recovery and Fail-Proof Call Delivery," invented by Kung et al.
- Furthermore, all United States or international patents or patent applications, whether published or unpublished and referenced herein should be deemed to be incorporated by reference as to their entire subject matter.
- What we claim is:
1. A method of providing alternate routing for a variable bit rate communication between a first terminal and a distant terminal to a broadband subscriber at the first terminal, the variable bit rate communication being a multimedia com-

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munication requiring an audio speaker and a video display and related to the degree of utilization of a plurality of different networks, the different networks comprising at least a packet switched network and a circuit-switched network, the method comprising the steps of: i) receiving a multimedia communication at a first terminal and ii) if the called party is not at a premises where the first terminal is located and the called party has authorized chasing service, setting a chasing data bit representing that the called party was not at a primary location and iii) alerting the calling party that the called party is not at the primary location and offering one of messaging service or chasing service to the calling party for the multimedia communication if the chasing data bit is set.

2. A method of routing a communication as recited in claim 1 further comprising the step of alerting the called party that the call is a chasing call.

3. A method of routing a communication as recited in claim 1 further comprising the step of comparing a terminal configuration for the called party with multimedia communication delivery requirements of the calling party.

4. A method as recited in claim 1 further comprising the step of converting the multimedia communication from one media to another.

5. A method as recited in claim 1 further comprising the initial step of receiving subscriber input data for chase me parameters.

6. A method as recited in claim 5 further comprising the step of storing said chase me parameters in memory of a subscriber identity module.

7. A method of routing a communication as recited in claim 1 wherein said first terminal comprises a camera for capturing a visual image and said multimedia communication comprises an audio communication simultaneous with a visual communication.

8. A method of routing a communication as recited in claim 1 wherein said first terminal further comprises a paging device equipped with a text display and said method further comprises the steps of:

converting an audible communication to a text communication and forming an e-mail comprising a control message and a text message and

forwarding said e-mail message to a paging server via an internet network.

9. A method of routing via alternative networks a calendar message, predetermined by the user for delivery at a prescribed date and time, comprising the steps of

receiving calendar input information regarding an event and a schedule;

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composing a calendar event message; and

chasing the user according to the reminder schedule and according to a predetermined priority of alternative network locations and terminal configurations to deliver the calendar event message, wherein the alternative networks comprise a circuit-switched network and a packet based network.

10. A method of routing a communication as recited in claim 9 wherein said calendar input information comprises a delivery address, a date and a greeting message.

11. A method of routing a communication as recited in claim 10 further comprising the step of composing a greeting message and delivering said greeting message to said delivery address.

12. A method of routing a communication as recited in claim 9 further comprising the steps of repeating delivery of the calendar event message until the event occurs.

13. A method of routing a communication as recited in claim 9 further comprising the step of routing the message to a paging server by e-mail for delivery.

14. A method of providing alternate routing for a variable bit rate communication between a first terminal and a distant terminal to a broadband subscriber at the first terminal, the variable bit rate communication being a multimedia communication requiring an audio speaker and a video display and related to the degree of utilization of a plurality of different networks, the different networks comprising at least a packet switched network and a circuit-switched network, the method comprising the steps of: i) receiving a multimedia communication at a first terminal and ii) if the called party is not at a premises where the first terminal is located and the called party has authorized chasing service, alerting the calling party that the called party is not at the primary location and offering one of messaging service or chasing service to the calling party for the multimedia communication.

15. A method of routing a communication as recited in claim 14 further comprising the step of alerting the called party that the call is a chasing call.

16. A method of routing a communication as recited in claim 14 further comprising the step of comparing a terminal configuration for the called party with multimedia communication delivery requirements of the calling party.

17. A method as recited in claim 14 further comprising the step of converting the multimedia communication from one media to another.

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